08599

1.0

.45   2 8   2.5

3 2   2.2

3 6

1.1   .40   2.0

1.8

1.25   1.4   1.6

MICROCOPY RESOLUTION TEST CHART

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NAVAL AIR ENGINEERING CENTER

REPORT NAEC-92-139

LAKEHURST, N.J.
08733

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APPLICATION OF A MICROCOMPUTER
TO A MOBILE ELECTRIC POWER PLANT

Handling & Servicing/Armament Division
Ground Support Equipment Department
Naval Air Engineering Center
Lakehurst, New Jersey   08733

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Final Report for Period July 1975 to September 1979
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APPLICATION OF A MICROCOMPUTER
TO A MOBILE ELECTRIC POWER PLANT

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains information relevant to a generator control system to be utilized in a new DOD Mobile Electric Power Plant (MEP354). An initial study revealed that a microcomputer control strategy was the most suitable system to use for this particular application. A breadboard system was built and tested to see if the controlled power complies with the applicable standard for ground power, MIL-STD-704C. Results obtained indicate that the microcomputer control system will regulate voltage and frequency to the extent called out in the aforementioned military standard.

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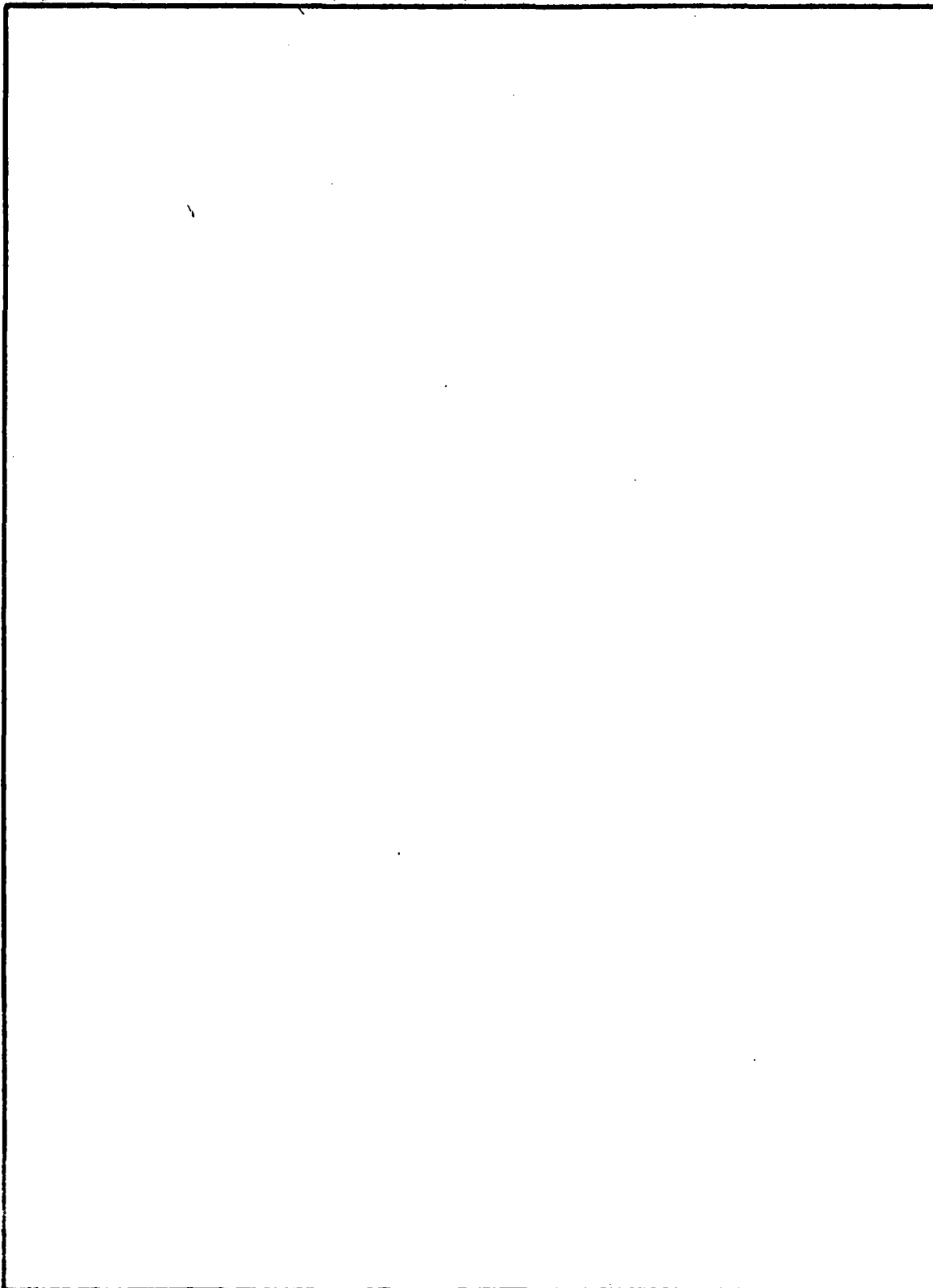
SUMMARY

A. **GENERAL**. The military standard pertaining to the quality of power generated by mobile electric ground support equipment presents rigid guidelines to be met. A control system is needed which will meet the goals of this standard with the least parts and costs, while maintaining a very high degree of reliability and maintainability. This report reveals why a microcomputer control system is appropriate and how such a system actually performed in a breadboard situation.

B. **PROCEDURES AND RESULTS**

1. A previous endeavor in the exploratory development area produced a generator that would conform to MIL-STD-704C (NAVAIRENGCEN report number NAEC-92-125). The Franklin Institute Research Laboratories in Philadelphia, Pennsylvania, under contract to NAVAIRENGCEN, completed a study to ascertain the optimum control method for an auxiliary power unit alternator. The report issued, which is included in its entirety as Appendix A, revealed that a microcomputer control system displays the most favorable characteristics of the various systems addressed.

2. A breadboard design of a microcomputer control system was built and tested for conformance to MIL-STD-704C. Results, as displayed graphically in Appendix D, indicate that a microcomputer control system will regulate the electrical characteristics of the particular generator used, as required in MIL-STD-704C. It is recommended that a microcomputer control scheme as exemplified in the report be included in MEP 354.

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I. INTRODUCTION

The performance of electrical and electronic equipment is largely dependent on the quality of power supplied to it. AC devices will perform satisfactorily if the input power is of the specified amplitude and frequency with a limited amount of tolerable distortion. It is essential that these devices receive the expected quality of power. Degradation of performance, abbreviation of service life, inefficient operation, and heating problems all are related to the application of improper input power, whether under steady state or transient operating conditions.

The current military standard which defines the electrical power requirements supplied to the utilization equipment aboard aircraft is MIL-STD-704C. Due to its stringent requirements, the ground support equipment community recognized a need to develop new Mobile Electric Power Plants (MEPPs) which would be able to supply the specified power to aircraft during ground maintenance and preflight checks. MEP 354 is the DOD designation for the new MEPP which will replace two older units, the NC-8A and the NC-2A. This report documents the investigation that led to the selection and testing of a generator control system.

II. BACKGROUND

The Fleet's need for a quality of power as defined in MIL-STD-704C is the driving force behind an effort to build a new Mobile Electric Power Plant, MEP 354. A previous study was made to obtain a generator that was most likely to comply with the new standard. A DOD 30KW diesel-driven generator was obtained due to its favorable electro-mechanical characteristics and availability. A computer program was written to calculate the expected electrical parameters of this generator set. Verification of the computer results was completed through a comprehensive test program as delineated in the appropriate military standard test directive, MIL-STD-705B.

Design changes stemming from the above tests were incorporated in the generator to achieve a generator that complies with MIL-STD-704C.

A later study, which is enclosed as Appendix A, indicated that a standard microcomputer control system would be the most suitable control system for the generator set. The decision was based on several parameters including, ability to meet the voltage regulation requirements, development costs, hardware costs, and operational costs. Based on this conclusion, a standard microcomputer board was obtained (Intel 80/10) and a breadboard control system was set up and tested. The goal of this report is to indicate that such a system works very well. The voltage and frequency characteristics obtained by the breadboard microcomputer system met both the steady-state and transient requirements of MIL-STD-704C.

III. OBJECTIVES

The objective of this effort was to obtain a generator control system which would regulate a generator's output characteristics and meet the new standard for aircraft/ground support power, MIL-STD-704C. Desirable attributes of the control system are simplicity (in terms of the fewest number of parts), reliability, maintainability, and low cost (both initial and life cycle).

IV. APPROACH

Once it was determined that a microcomputer control system exhibited the best characteristics for our application, a standard microcomputer board was obtained. Control algorithms for both voltage and frequency were drawn up. From these algorithms a detailed machine language program was written. Next, the necessary hardware to support the computer program was designed and built into a breadboard system. Finally, the polished system was tested for conformance to MIL-STD-704C.

V. SYSTEM DESCRIPTION

The control algorithms and the theory behind them, software flowcharts, and the actual program listing are included as Appendix B. The supporting hardware, built around an Intel 8080 microprocessor on an 80/10 microcomputer board, is enclosed as Appendix C.

VI. DISCUSSION OF RESULTS

Appendix D gives vivid evidence of the performance of the microcomputer control system for both voltage and frequency. With the diesel-generator set's battery voltage applied to the field and an external resistor of 1.5 ohms placed in series with the field, the voltage regulation characteristics met the transient and steady-state requirements of MIL-STD-704C. Using a 4-cylinder Hercules-White engine and a 15KW Electric Machine generator, a 15 KW, 0.8 power factor load was used to determine the regulator response. Figure D-1 illustrates that the voltage does get back within the steady-state limits in the required time span.

Utilizing the same engine and generator with a Woodward electrohydraulic governor, the frequency response was tested again with a 15KW, 0.8 power factor load (rated load). Figure D-2 displays the frequency control system's response. The frequency stabilizes within the steady-state limits in 2.25 seconds. Clearly, this is well within the allowable 10 seconds from removal or application of load.

It is therefore concluded that the chosen microcomputer control system did effectively regulate the DOD engine-generator set's voltage and frequency response to comply with the specifications of MIL-STD-704C.

VII. CONCLUSIONS AND RECOMMENDATIONS

This program consisted of a comparative study of possible control systems, algorithm and computer program writing, breadboard building and testing, and an evaluation of the final system. Results, depicted graphically in Appendix D and discussed previously, indicated that a microcomputer control system, when used in conjunction with the particular DOD diesel-driven generator set, meets the requirements of MIL-STD-704C.

It is recommended that a microcomputer system be included in the total MEP 354 development package as the AC voltage and frequency control system. It is further recommended that a Woodward type of electrohydraulic governor system be employed on the diesel engine.

A microcomputer is a versatile and powerful tool. The Intel 8080 micro-processor performed very well as the core of the control system. Nevertheless, it has ample capacity to control or monitor other functions besides AC voltage and frequency. Control of DC voltage for a transformer rectifier unit and monitoring of key parameters such as over/under voltage, excessive current draw, oil pressure, water temperature, and other functions could very well be performed by the 8080. At the onset of this program the 8080 was at the van-guard of the industry. However, the electronics industry is progressing at a very rapid rate, particularly in the digital field. Current microprocessors are more powerful and faster, and have a larger supply of peripheral packages to support them than those which existed a few years ago. It would prove worthwhile to incorporate the most advantageous and well-supported microprocessor in MEP 354.

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APPENDICES

APPENDIX A

FEASIBILITY STUDY OF OPTIMUM CONTROL METHODS
FOR AUXILIARY POWER UNIT ALTERNATOR

SUMMARY

The objective of the study was the selection of a design strategy for a motor generator controller. The first step was to establish specific design goals. These goals included compliance with MIL-STD-704B, MIL-D-8512 and MIL-T-21200L. The next step was the analysis of the equipment to be controlled--alternators and diesel engines.

Once the goals and restrictions were established, the study of various system design strategies was begun. The major area of investigation was in design techniques to achieve the required voltage regulation. These techniques were divided into three major categories: analog, digital and hybrid. Several methods in each category were evaluated; many through computer simulation. The investigation determined that methods in all three categories could meet the regulation goals.

Having established the feasibility of meeting the voltage regulation goals, the selection of the best strategy to meet the overall goals of the motor generator was made. This selection was based on many factors including: development costs, hardware costs and operational costs. The main conclusion was that the motor generator controller should be based around a standard microcomputer using a saturating control type of regulation.

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CONTENTS (Continued)

ILLUSTRATIONS

ILLUSTRATIONS (Continued)

1. DESIGN GOALS

The general goal of this study was the selection of the optimum design strategy for a motor generator (AC-APU) controller. The controller must meet all specifications and standards for use with motor generator sets rated from 15 KW to 100 KW.

Specifically, the motor generator controller must meet the following military standards and specifications:

MIL-STD-704B	Military Standard, Aircraft Electric Power Characteristics
MIL-D-8512	Military Specification, Design; Special Support Equipment
MIL-T-21200L	Gen. Spec. for Test Equip. for Use with Electronic and Electrical Equipment

This section is a discussion of the AC-APU design goals as they relate to regulation, environment, and general operation. The goals were derived by FIRL from the referenced military standards and specifications, and from discussions with Naval Air Engineering Center personnel.

1.1 REGULATION

The voltage and frequency of the AC-APU must be regulated to the required standards set forth in MIL-STD-704B. These standards require that the voltage not exceed the time envelope profile shown in Figure 1-1, and that the frequency remain within 1.25% except during load transient conditions. These goals are attainable only through use of servo systems in which a reference standard is compared to the variables to be controlled (voltage and frequency) and as a result the error is amplified to a level that will correct the variables. The amount of amplification required is a function of the allowable error. This can be expressed as:
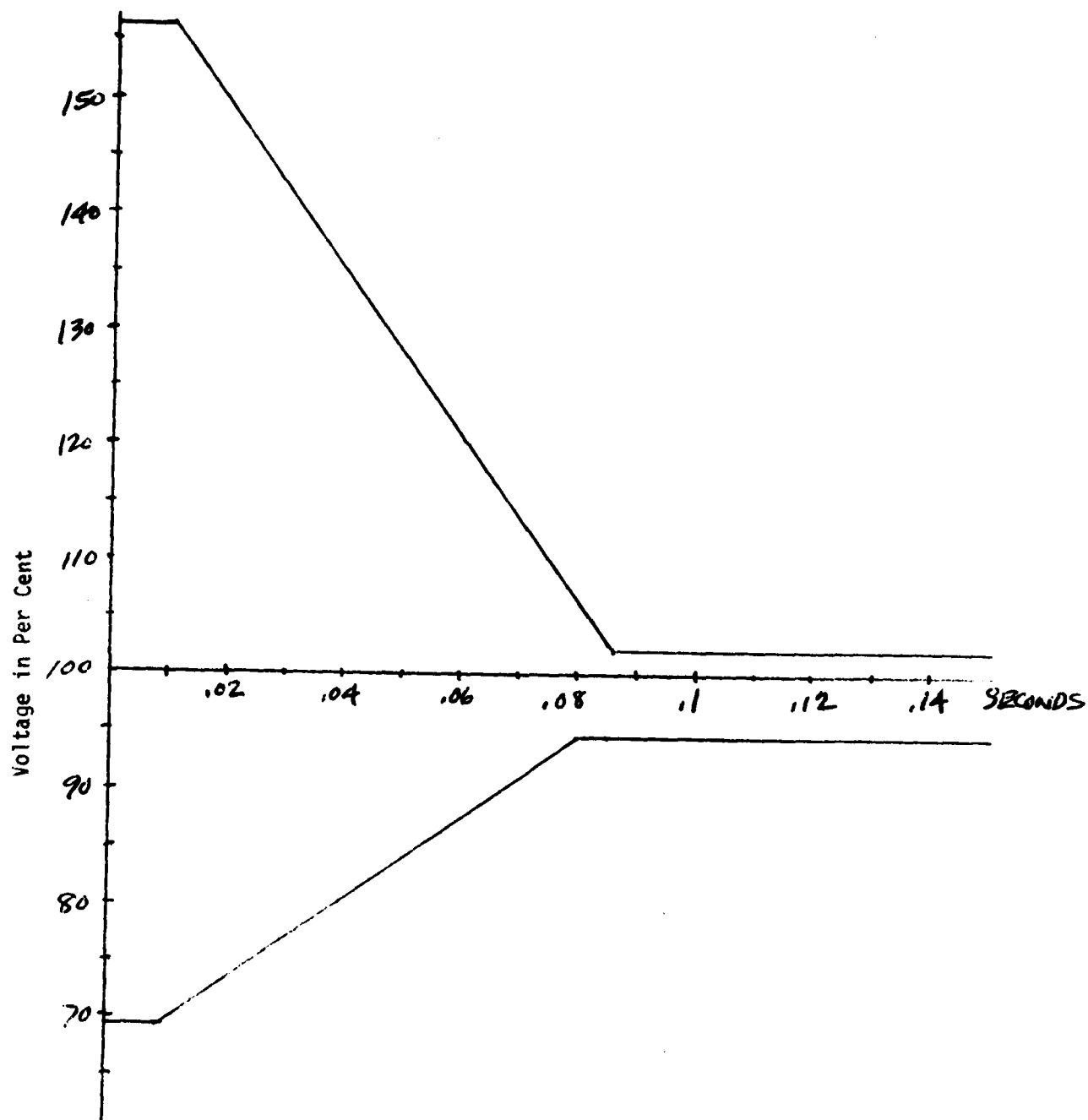
Figure 1-1. Envelope of AC Voltage Surge

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$$E = e_r - e_v$$

$$e_v = EG = (e_r - e_v) G$$

$$\frac{e_v}{e_r} = \frac{G}{1 + G}$$

For 1% regulation:

$$\frac{99}{100} = \frac{G}{1 + G}$$

$$G = 99$$

1.2 ENVIRONMENTAL GOALS

A summary of the environmental requirements for the motor generator controller follows.

Temperature altitude - See Figure 1-2.

Humidity - Up to 100% humidity, condensing on and in equipment in operating and non-operational modes.

Vibration - Must be capable of withstanding a logarithmetic sweep of 5 to 55 to 5 Hertz (sinewave) in 15 minutes at the following amplitudes:

Frequency Hertz	Double Amplitude
5 to 15	.06 in.
15 to 25	.04 in.
25 to 55	.02 in.

Shock - Must be capable of withstanding 18 shocks of 15g.

General - Must operate effectively under the following conditions: sand, dust, salt, snow, rain, ice.

- Must be mildew resistant
- Must be usable by a person wearing heavy arctic clothing
- Must be shielded against radiated interference.

1.3 OPERATIONAL GOALS

MIL-STD-704B states the specifications of the controller in terms of voltage regulation, frequency regulation, etc. However, a major goal

TEMPERATURE/ALTITUDE

Operating			Non-Operating	
Temperature Extremes °C				
Continuous	Intermittant 20 Min.	Altitude	Temperature Extremes °C	Altitude Maximum
-54 to +55	+71	0 to 10,000 ft. (30.0 to 20.6 in Hg.	-62 to +85	50,000 ft. (3.4 in. Hg)

Figure 1-2. Temperature/Altitude Requirements for Motor Generator Controller

of this study was to insure that the AC-APU will be easy to operate and repair. Therefore, the complete controller will not only control but monitor and diagnose as well.

The regulator portion should:

- Meet all applicable standards and specifications
- Be of simple design
- Be adjustable over a range of output voltage

The goals of the monitor function are as follows:

- The following parameters should be continuously monitored:
  - voltage
  - current
  - frequency
  - speed
  - oil pressure
  - fuel level
  - coolant temperature
- These parameters should be presented to the operator on demand and the appropriate parameters should be automatically

presented when abnormal operation is detected.

- The presentation of information to the operator should be simple to understand. Where possible, this information is to be presented in "GO/NO GO" format.

- Operator actions required to obtain monitored information should be simple.

- The number of displays should be minimized.

- All necessary displays should be located centrally.

The goals of the diagnostic function are as follows:

- The diagnostics should act in conjunction with the monitoring function to detect and control abnormal conditions. Abnormal conditions include:
    - over/under voltage
    - over/under frequency
    - over current
    - over temperature
    - low fuel level
    - low oil pressure
    - low oil level
    - low coolant level

- Ideally, the diagnostics should detect not only absolute faults (e.g. overcurrent) but potential faults (e.g. sharp rise in temperature).

- The diagnostics should minimize operator involvement and be completely automatic.

- The diagnostics should permit total check out of the motor generator set and controller. Ideally, the diagnostics should pin point any faulty electrical or mechanical components and be performed while the AC-APU is in operation.

- Any non-automatic diagnostics should be easy to use.

- Ideally, the total diagnostic feature should be self-contained in the motor generator controller. However, a separate peripheral device to perform detailed diagnostics may be considered if cost, size and operation factors are beneficial.

2. ANALYSIS OF ALTERNATORS

The closed loop system to regulate voltage and frequency of an alternator requires that the characteristics of the alternator be known in terms of time variable expressions. The alternator consists of a field winding used to provide rotor flux and a stator winding that is cut by these lines of flux to provide a sinusoidal voltage whose frequency is determined by the number of pairs of poles and rotor speed. Since each item is critical to the successful design of the control system for the alternator, each was examined separately.

2.1 FIELD WINDING

The field winding has a time variable expression related to the inductance and resistance of the winding. Since current is related to the field flux, the transfer characteristic is desired between current and applied voltage.

$$E = IR + L \frac{dI}{dt}$$

Using the Laplace transform S for d/dt

$$E = IR + SIL$$

$$\frac{I}{E} = \frac{1}{R + SL}$$

The real term in the denominator is R and when the imaginary term (SL) is equal to R, the phase angle will be 45° and the amplitude will decrease to .707 of the D.C. amplitude. The relation of (L/R) is known as the time constant of the system and appears at a frequency determined by

$$f = \frac{1}{2\pi \, (L/R)}$$

2.2 REGULATION

If the alternator had no inherent regulation due to load, there
would be no need for the development of a regulator. Unfortunately,
every alternator has inherent regulation due to the effective impedance
that appears between the generated voltage and the terminal voltage.
The amount of regulation varies with machine design and is a measure of
decrease in terminal voltage when full load current is drawn from the
alternator. The specific design considered in the analog computer simu-
lation has a regulation that is calculated to be between 8 and 10 per
cent from no load to full load.

2.3 EXCITER SYSTEM

The field excitation can be derived from a static source such as
battery or A.C. rectified. The exciter must provide a D.C. power suffi-
cient to fully saturate the field. Field excitation can also be obtained
by use of a generator on the same shaft as the alternator. Some designs
use D.C. generators with brushes to pick off the D.C. power which is to
be delivered to the field. More recent exciter designs use brushless
types of exciters which have no parts that will wear. Such designs
therefore are nearly maintenance free. The penalty to be paid for such
a design is the effect of an additional time constant that makes the con-
trol loop more difficult to stabilize.

2.4 NON-LINEAR OR SATURATION CONSIDERATIONS

The relation of field current to flux developed in the air gap of
the alternator is fairly linear over a portion of the operating range.
Normally the operating point is placed just beyond the knee of the curve
so that when higher flux is needed to overcome the inherent regulation
characteristics, the ratio of current to flux is not the same as found
under no-load conditions. Since the non-linear transfer characteristic
of the field is in the control loop, the loop gain is not constant but
varies with load current. At no load the gain is higher than at full
load.

Each of these characteristics have been determined in general form so that any alternator design can be simulated by this technique. Parameters have been determined for a specific alternator for this study and the derivation of the parameters are included in Appendix A.

The block diagram representing the alternator is shown in Figure 2-1. E_{ex} is the exciter input voltage. The gain and dynamics of the exciter are represented by K_{ex}/R_{ex} $(L_{ex}/R_{ex} S + 1)$ and the output voltage E_f is the voltage delivered to the main field winding. The dynamics of the main field are represented by $1/R_f(L_f/R_f S + 1)$ with the gain K_f and an output in terms of flux appearing in the alternator air gap.

The voltage gain constant K_e multiplied by rotor speed $S\theta_G$ will develop the generated voltage which through the internal impedance of the rotor represented by the regulating characteristic $R_\ell/(R_G + R_\ell)$ will produce the terminal voltage E_ℓ.

The terminal voltage multiplied by the conductance of the load $1/R_\ell$ will produce the load current I_ℓ. The load current multiplied by the torque constant K_T and scaled by the shaft spring constant, the combination of which is multiplied by the flux $\emptyset$ will produce the generator torque T_G.
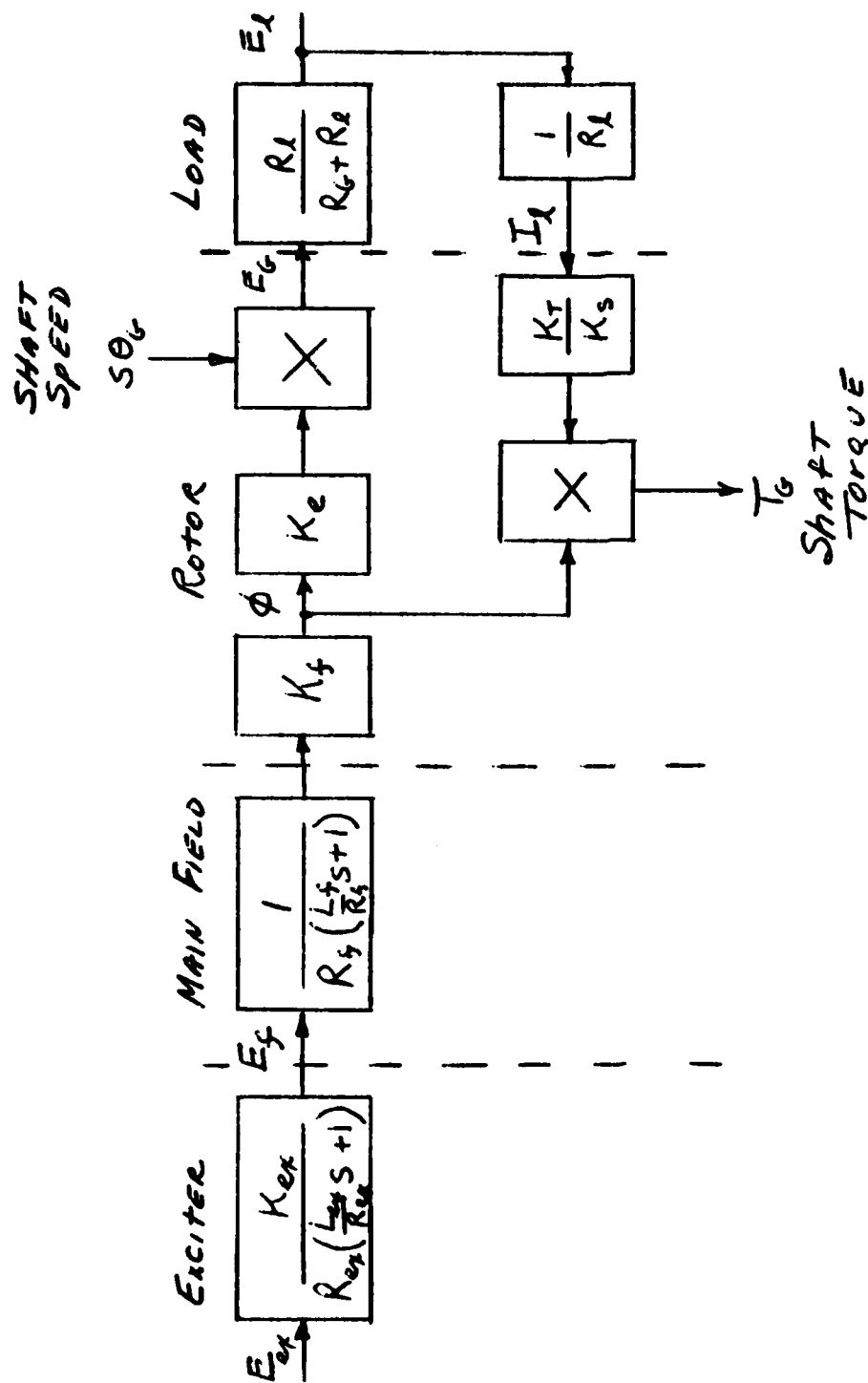
Figure 2-1. Alternator Block Diagram

3. ANALYSIS OF DIESEL ENGINE

The application of a diesel engine to drive an alternator requires far better speed control than that required for a D.C. generator. Since frequency is directly related to shaft speed, the shaft speed should be kept constant regardless of load conditions. As in the analysis of the alternator the closed loop system to regulate speed required that the characteristics of the diesel be known in terms of time variable expressions. Since each item is critical to the successful design of the governor for the engine, they are discussed separately.

3.1 ROTATING INERTIA

The rotating inertia of the system consists of the diesel engine inertia coupled by shaft to the alternator inertia. The shaft has an angular spring rate. The inertia will develop a force due to angular acceleration or rate of change of shaft velocity. The shaft angular spring rate combined with the inertia of the engine and the alternator have a natural frequency that is determined by $\sqrt{\dfrac{K}{J}}$.

3.2 TORQUE VERSUS FUEL FLOW

The fuel flow system versus developed torque is fairly constant regardless of shaft speed. For the analog computer simulation, it has been considered constant.

3.3 THROTTLE CONTROL

The flow of fuel into the engine must be controlled and in order to maintain constant speed, the throttle opening must be controlled by the error between the speed reference and the actual shaft speed. The time variable element in the throttle system is the moving valve piece. The valve piece has inertia, damping and, in most cases, a spring to return

it to the closed position. Valves that are operated by electrical force coils have a time constant due to the inductance and resistance of the coil.

Each of these characteristics have been determined in general form so that any diesel engine design can be simulated. For this study, parameters have been determined for a specific engine and the derivation of the parameters is included in the appendix.

The block diagram representing the diesel engine is shown in Figure 3-1. The input voltage to the flow control valve is shown as E_γ. This voltage through the coil dynamics $1/R_S(L_S R_S S + 1)$ and the mechanical dynamics of the valve represented by $1/[J_T/K_S S^2 + K_D/K_S S + 1]$ with a gain of $K K_{S\gamma}$ will produce a valve displacement represented by X_T. The valve displacement will provide flow of fuel to the diesel engine and a torque T_D will be developed in proportion to the engine gain K_1. The resultant torque applied to the shaft coupling diesel engine to alternator rotor is derived from the developed torque T_D minus the torque due to change of shaft speed through the dynamics of $K_D(J_D/K_S S + 1)$. The dynamics of the shaft are represented by $1/K_S(J_D/K_S S^2 + K_D/K_S S + 1)$. The resultant torque from the shaft when summed with the alternator torque T_G will accelerate the alternator inertia and overcome friction and windage described in the block with gain and dynamics of $K_S/K_D (J_G/K_D S + 1)$ and an output of shaft speed $S\theta_G$.
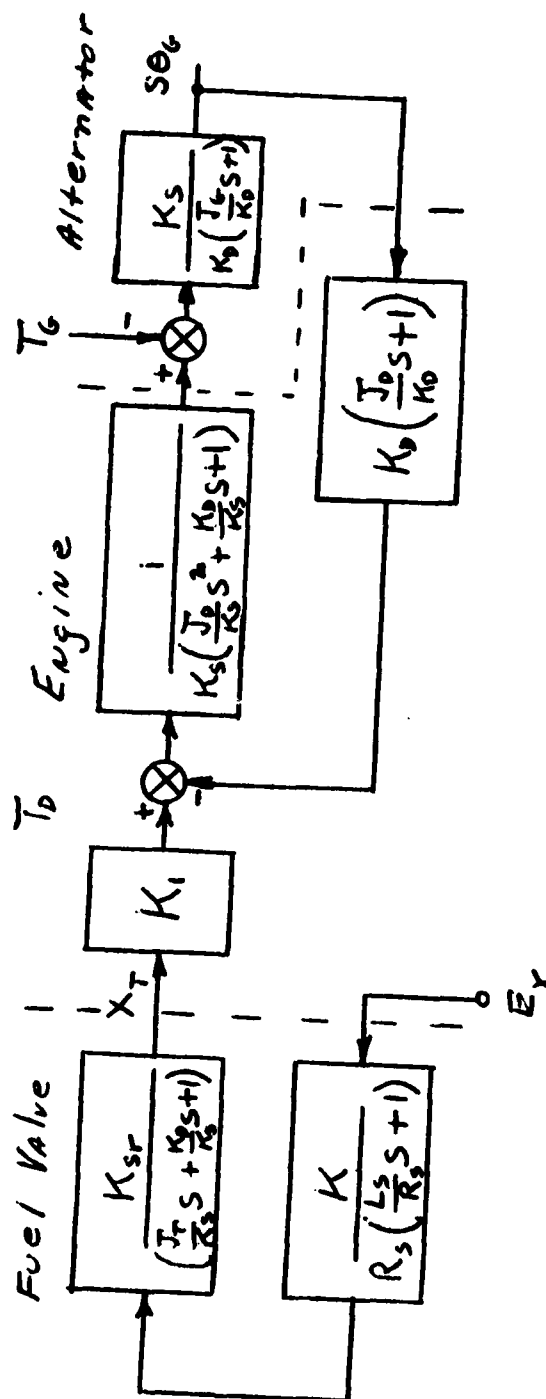
Figure 3-1. Diesel Engine Block Diagram

4. SYSTEM DESIGN STRATEGIES

This section describes the various system design strategies considered for the motor/generator controller and the analysis of calculations and test results.

In order to maintain a reference point, the discussion of the voltage regulator hardware and design trade-offs assumes that a microcomputer will be used for the monitoring and diagnostic functions. A general block diagram of the monitoring and diagnostic system is presented in Figure 4-1. The block diagram is discussed in detail in Section 4.5.3.

4.1 LITERATURE SEARCH AND REVIEW

A computerized literature search was performed to aid in the selection of regulator design strategies. The search retrieved information from three data bases:

Engineering Index
Institute of Electrical Engineers (IEE)
Information Service of Mechanic Engineering (ISMEC)

The results of the computer search are presented as Appendix B.

A review of the data obtained from the computer search and from other sources led to the selection of several regulation methods; these fall into the general categories - digital, analog and hybrid.

4.2 ANALOG METHOD OF CONTROL

The analog method of load voltage control from an alternator requires the use of continuous current. The amplitude of the current must vary in order to control the alternator field. The error voltage, that is the difference between reference voltage and load voltage, is a continuous voltage varying in amplitude. It is amplified to provide the necessary

ANALOG DIAGNOSTIC
INPUTS ≃ 5 LINES

MONITOR PARAMETERS
≃ 10 LINES

| DIAGNOSTIC TEST POINTS | DIAGNOSTIC TEST POINTS | CURRENT TRANSDUCER | OIL LEVEL TRANSDUCER |

OPERATOR'S CONSOLE

MULTIPLEXED A/D CONVERTER

DIAGNOSTIC TEST POINTS ≃ 5

μCOMPUTER

DIGITAL MULTIPLEXER

DIGITAL MULTIPLEXER

≃10

D/A

≃10

| COMMANDS TO CONTROL CIRCUITS | INDICATOR LAMPS | ALPHANUMERIC DISPLAY |
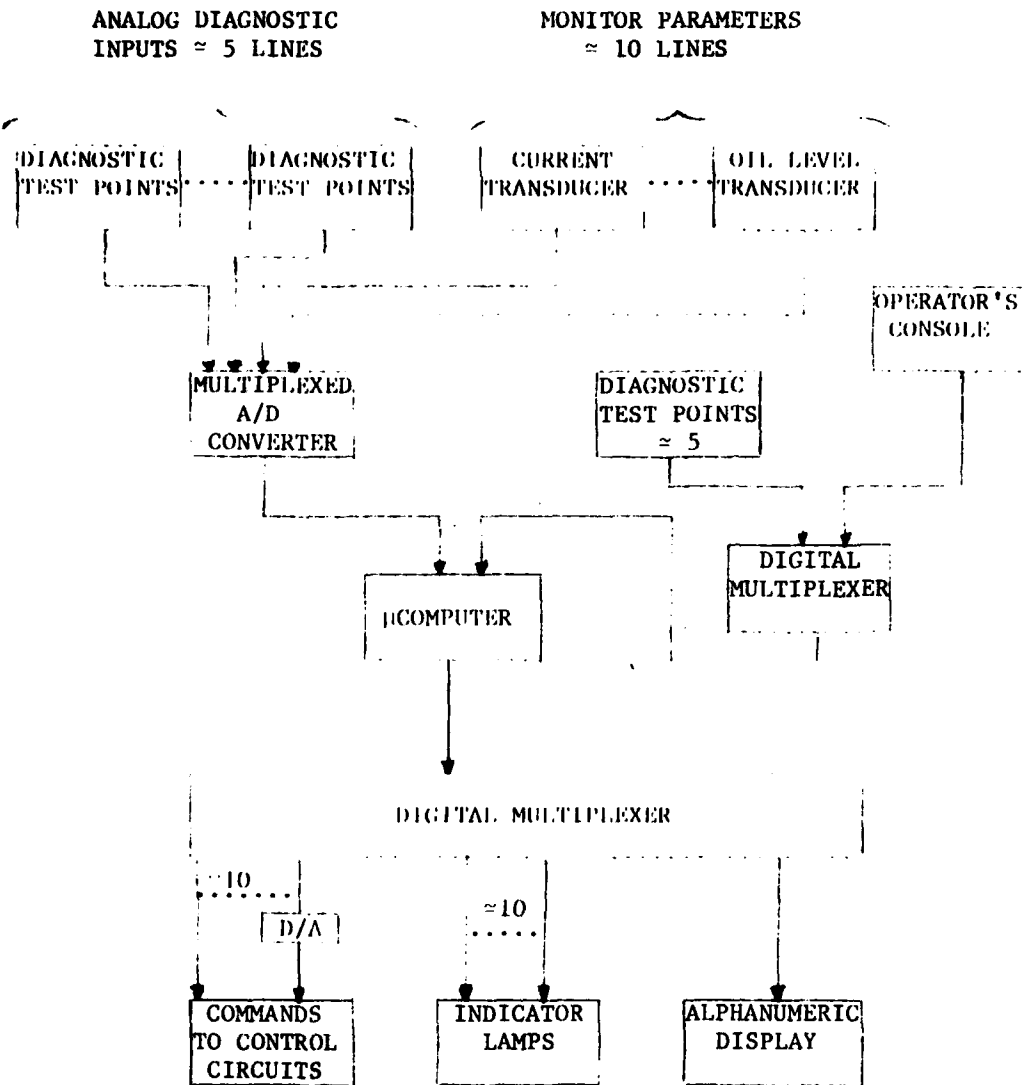
Figure 4.1.   General Block Diagram of the
Microcomputer Based Monitoring
and Diagnostic System

field current needed to hold the load voltage to the required level. The
most accurate system for this type of control is a type 1 system. This
differs from a type zero system in that a type zero system has an error
that is dependent upon loop gain. A type 1 system has an integration so
that under static conditions the error is zero.

The complete system of the diesel engine drive, governor, alternator
and voltage regulator have been simulated for the analog system. The
general form block diagram is shown in Figure 4-2. The description of
the symbols and the derivation of their numerical values are given in
Appendix A.

Referring to Figure 4-2, the shaft speed of the alternator $S\theta_G$ is the
controlled function that is desired to be constant. The speed as compared
to the reference $S\theta_V$ will produce an error e_D that may be a mechanical or
electrical signal used to drive the throttle valve the distance X_T.
Throttle displacement will produce fuel flow which through the gain con-
stant K_1 of the diesel engine will produce an output torque of T_D. This
torque will drive the combined inertia of the alternator (J_G) and diesel
engine (J_D) through the shaft spring constant (K_S). Since friction and
windage (K_D) are present some torque will be required even at constant
shaft speed and zero electrical load.

The alternator loop has a load voltage (E_ℓ) compared to a reference
voltage (E_r) to provide an error (e) as an input to the voltage regulator.
The voltage regulator will drive the exciter field which in turn will
drive the main field of the alternator. The field flux $(\emptyset)$ developed by
the main field excitation will generate a voltage (Eg) that is a product
of shaft speed $(S\theta_G)$ and field flux $(\emptyset)$ through a gain constant (K_e).
The load voltage (E_ℓ) will adjust in level in proportion to the load cur-
rent by virtue of the alternator inherent regulation characteristic.

The load current (I_ℓ) multiplied by the field flux $(\emptyset)$ will produce
a torque $\left(\dfrac{K_T \, I_\ell \emptyset}{K_S} \right)$ that will subtract from the shaft torque delivered

Figure 4-2. Alternator and Diesel Engine Block Diagram

to the alternator inertia thus slowing down the shaft speed.

From this block diagram and the constants derived in the appendix, the analog computer simulation was developed as shown in Figure 4-3. In Figure 4-3 the block designated as governor contains the electronic equivalent of the dynamics of the solenoid operated flow control valve to supply fuel flow to the engine. The input is an electronic voltage $S\theta_\gamma/100$ which when compared with the tachometer voltage representative of the shaft speed $S\theta_G/100$ will produce the error voltage necessary to produce the input to the diesel engine.

The input to the diesel engine has a non-symmetrical torque limit in which the acceleration torque is twice that of the deceleration. The dynamics of the shaft stiffness and diesel engine inertia are included in the block marked diesel engine. The block marked alternator has the torque input to the alternator dynamics including rotor inertia. Multipliers are used to generate developed torque from load current and field flux and shaft speed multiplied by field flux to develop generated voltage $E_G/10$. A feedback path in the amplifier used to convert $E_G/10$ to $E_\ell/10$ establishes alternator regulation due to load. A second amplifier with a bias input is provided to facilitate a larger scale voltage of the load voltage as designated by $\Delta E_\ell/2$. Regulation and dynamics of the alternator can be more accurately determined using this means of offset or bias level cancelling. The exciter input shown in the exciter block comes from a voltage regulator that has an input from E_ℓ and provides gain and compensation to stabilize the loop. The exciter block contains the gain and dynamics of the exciter used to drive the main field.

Of the many runs that were made, those recorded for the 10% and 15% inherent regulation with and without the compensation needed to bring the transient within the allowable limits of the MIL-STD-704B are discussed in the following paragraphs.

The alternator with 10% inherent regulation is shown in Figure 4-4 with a voltage regulator system of nominal control characteristics. The characteristics include compensating networks that are in the AC voltage regulator design shown in Figure 1-12 of the NAVAIR 19-45-19 report. Using this as a starting point, a voltage regulation characteristic as recorded in Figure 4-5 was obtained. The load current $I_\ell/2$ is equivalent to full load at unity power factor. The initial drop in load voltage due to inherent regulation is observed in the trace of $-\Delta E_\ell/2$. Close study shows that when load is applied the frequency of ringing is lower than when load is removed and the first overshoot is of lesser amplitude.

The alternator shaft speed $S\theta_G/100$ equivalent to 209 rad/sec or 2000 rpm shows a decrease in speed when load is applied. Since this is a type zero regulator, the speed will not return to the initial or unloaded speed since some error must exist and is directly related to loop gain. The torque shows an increase when load is applied as recorded in $T/50$. Since the characteristics of the diesel engine are approximated for this simulation, the levels have not been calibrated precisely.

The selected loop gain produces a system response that falls just outside the allowable parameters. The natural frequency of the underdamped voltage wave measures to be 0.09 sec/cycle or 11.1 Hz. Since the system has a damping characteristic of close to 0.1 and it is desired to maintain approximately the same speed of response, a compensating network in the forward loop of the voltage regulator was added. This is in the form of a lead lag network with the lead term set for 3.35 Hz and the lag at 13.7 Hz thus producing positive phase shift in the range of 11 Hz. The schematic
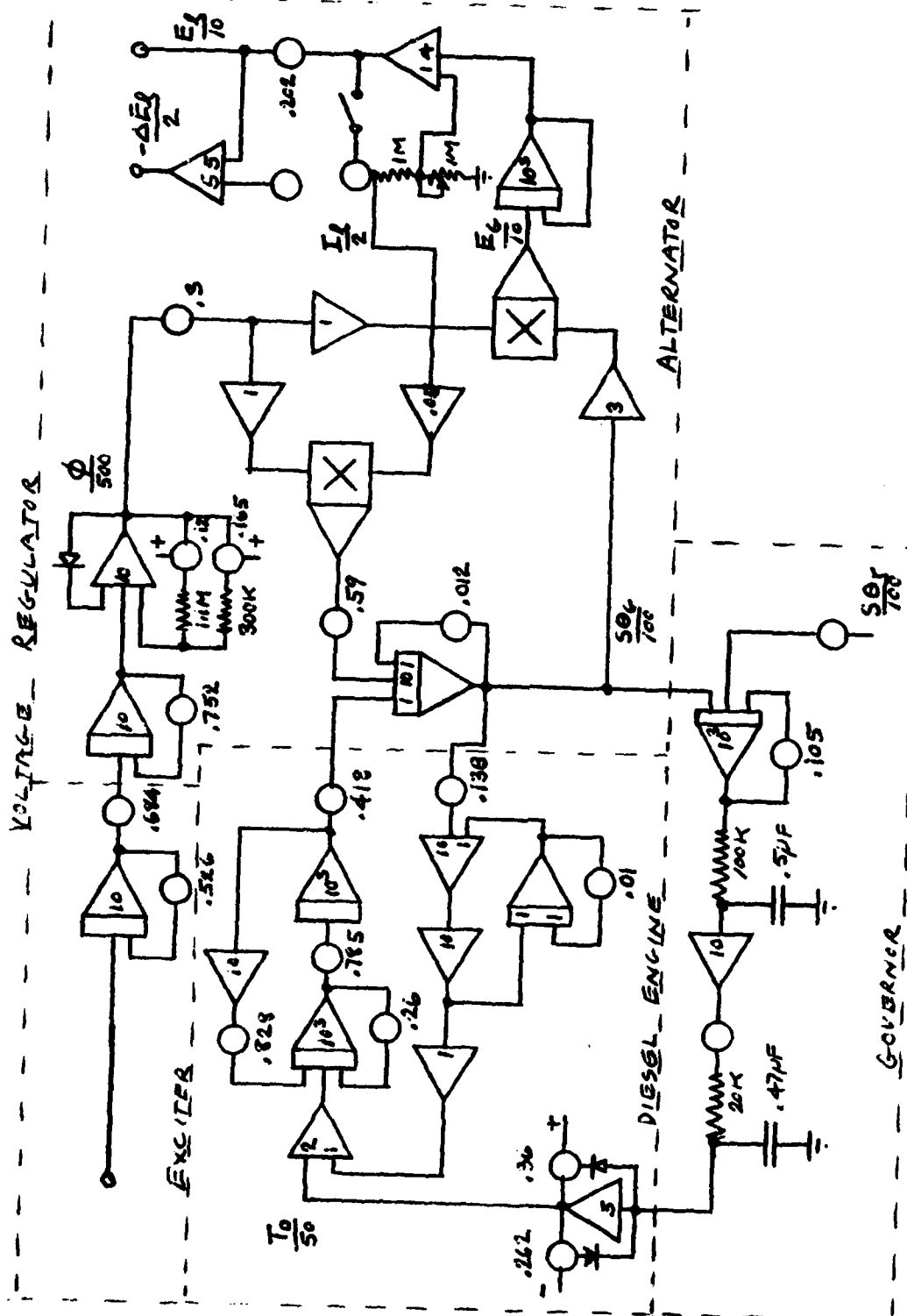
Figure 4-3. AC-APU Analog Computer Program
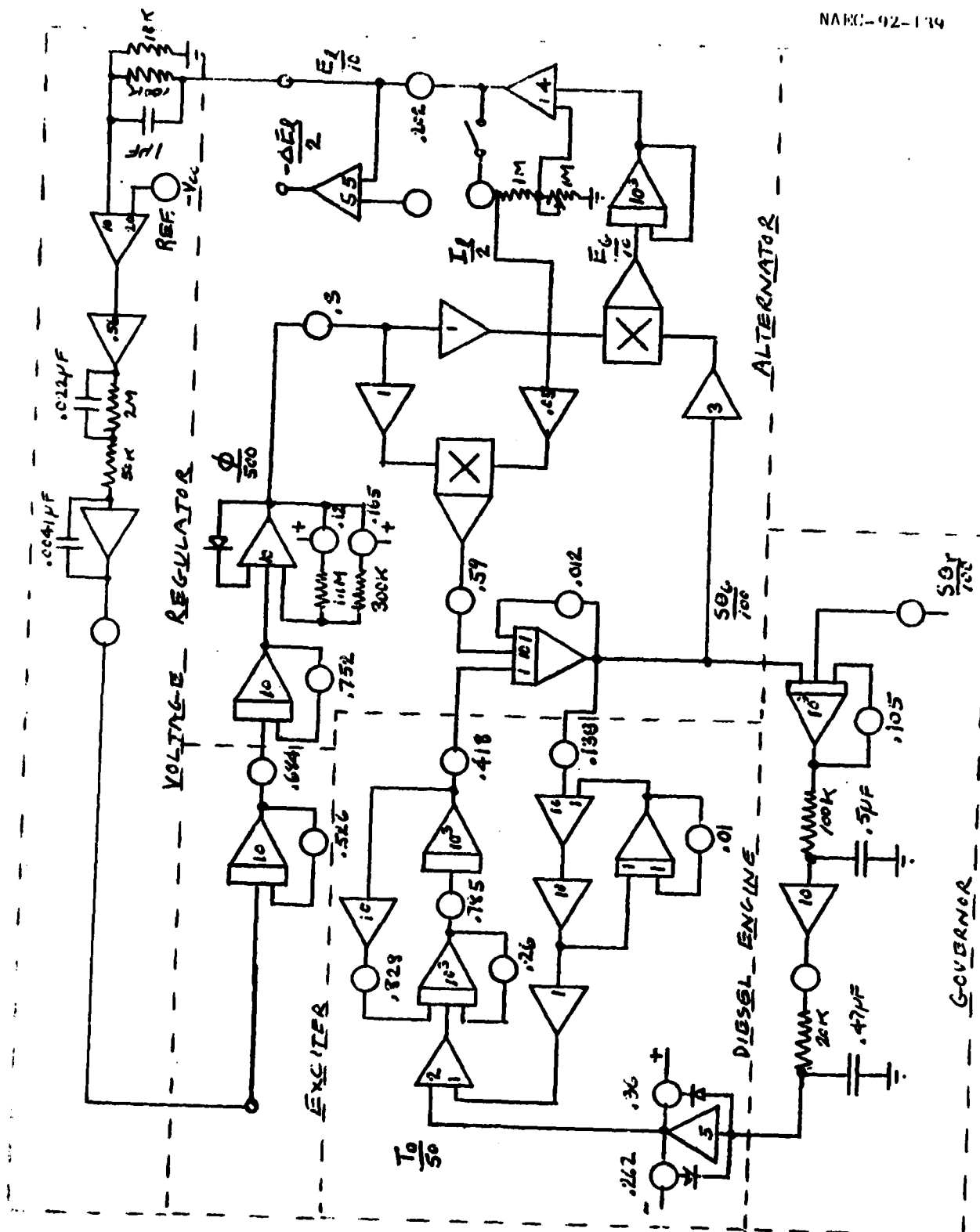
Figure 4-4. AC-APU Analog Computer Program

NO FORWARD LOOP COMPENSATION
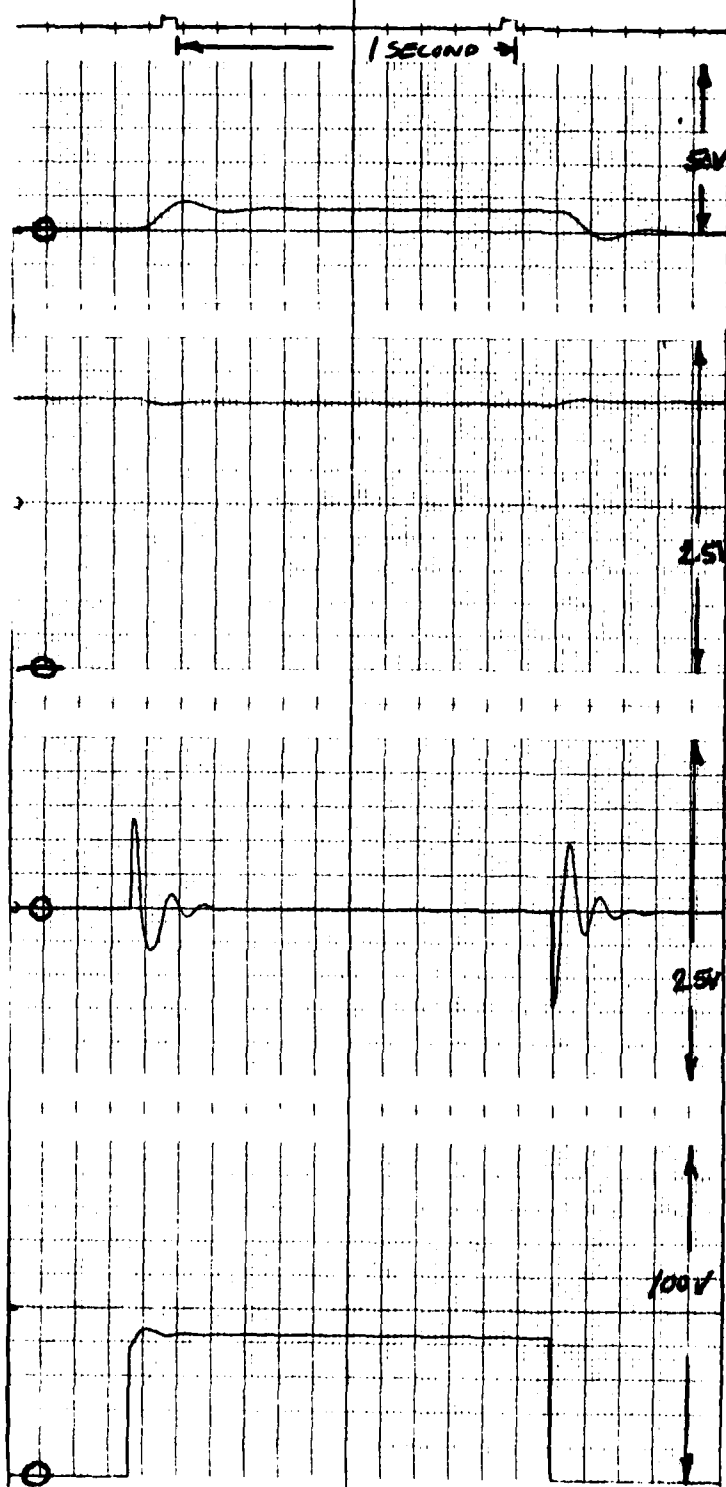
$$\frac{T_D}{50}$$

$$\frac{SG_L}{100}$$

$$-\frac{\Delta E_l}{2}$$

$$\frac{I_l}{2}$$

Figure 4-5. Alternator 10% Inherent Regulation

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for this system is shown in Figure 4-6. The results of this compensation with adjustment of loop gain for optimum performance is shown in Figure 4-7. The system performance exhibits much greater damping and fits well within the allowable limits.

The same system characteristics as shown in Figures 4-4 and 4-6 have been used for the alternator with a 15% inherent regulation. Figure 4-8 is for the uncompensated system where the amplitude of regulation is much larger than that for the 10% design. Similar damping characteristics are observed. The compensation network does help in this design but would have to be modified to provide optimum performance. The compensated response is shown in Figure 4-9 and has identical compensation to that shown in Figure 4-6.

4.2.1 Compensation Selection

The linear analysis of the alternator and voltage regulator shown in Figure 4-4 has been calculated and plotted in Figure 4-10 with gain recorded as M_1 and phase shift as $\emptyset$. In order to fit within the time profile of the transient response, the bandwidth of response must be in the order of 10 Hz or higher. This requires that the open loop gain of the system should be at least 57 db/S. Plotting the phase and gain characteristics of the open loop transfer on the Nichols chart shown in Figure 4-11, the characteristics of the closed loop response are obtained. This response is plotted in Figure 4-12 as closed loop nominal amplitude (M_1) versus frequency. The system has a definite characteristic of low damping as evidenced by the 4.5 db peak around 16 Hz. Since the phase shift shown in Figure 4-10 for $\emptyset_1$ is nearly constant at 140° from 1 Hz to 10 Hz, this peak would be of the same amplitude for gains between 37 db/S and 57 db/S. The frequency of the peak would vary from 1.6 Hz to 16 Hz depending upon gain.

The approach used for compensation is to add positive phase shift to bring the phase angle back to 120 degrees or less at around 10 Hz. A compensation network with the lead and lag separated by a ratio of 4:1 will provide a maximum leading phase shift of 37 degrees when the lead is at a lower frequency than the lag. This characteristic has been included in Figure 4-10 as M_2 and $\emptyset_2$ when incorporated with the alternator and voltage regulator characteristic of M_1. The phase and gain plotted on the Nichols chart of Figure 4-13 provides the open loop to closed loop response for the
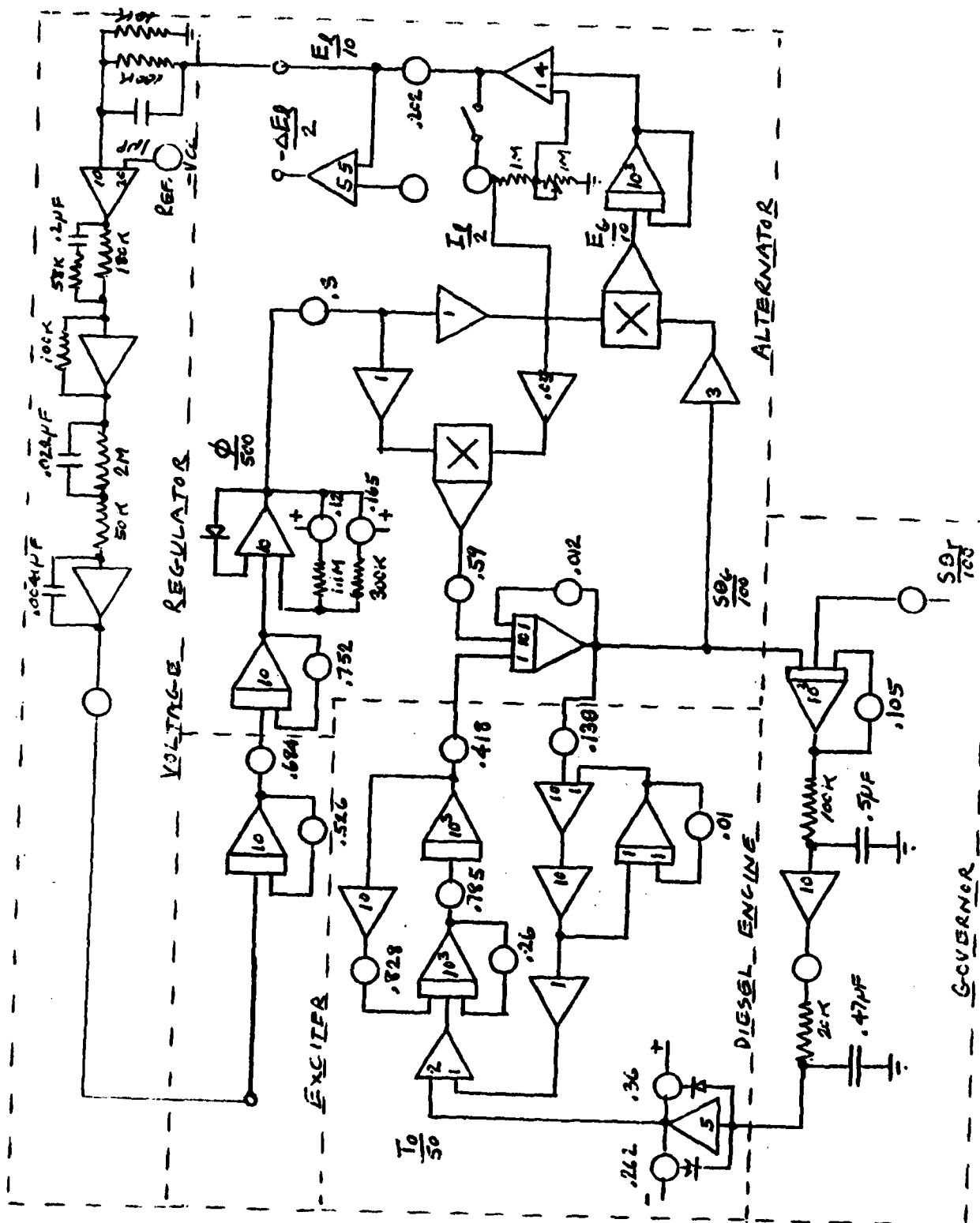
Figure 4-6. AC-APU Analog Computer Program

WITH FORWARD LOOP COMPENSATION
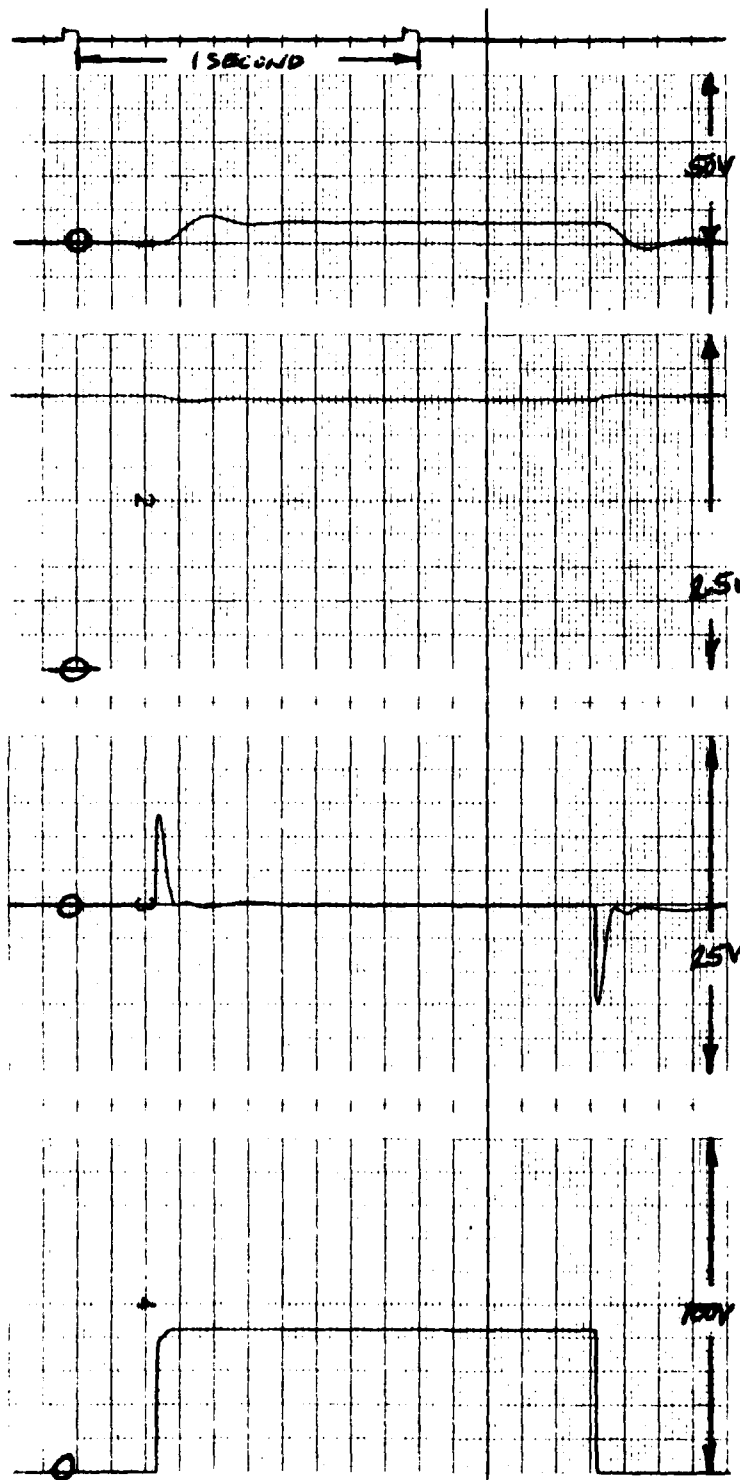
Figure 4-7. Alternator 10% Inherent Regulation

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No Forward Loop Compensation

$$\frac{T_D}{50}$$

$$\frac{S\theta_G}{100}$$

$$-\frac{\Delta E\ell}{2}$$
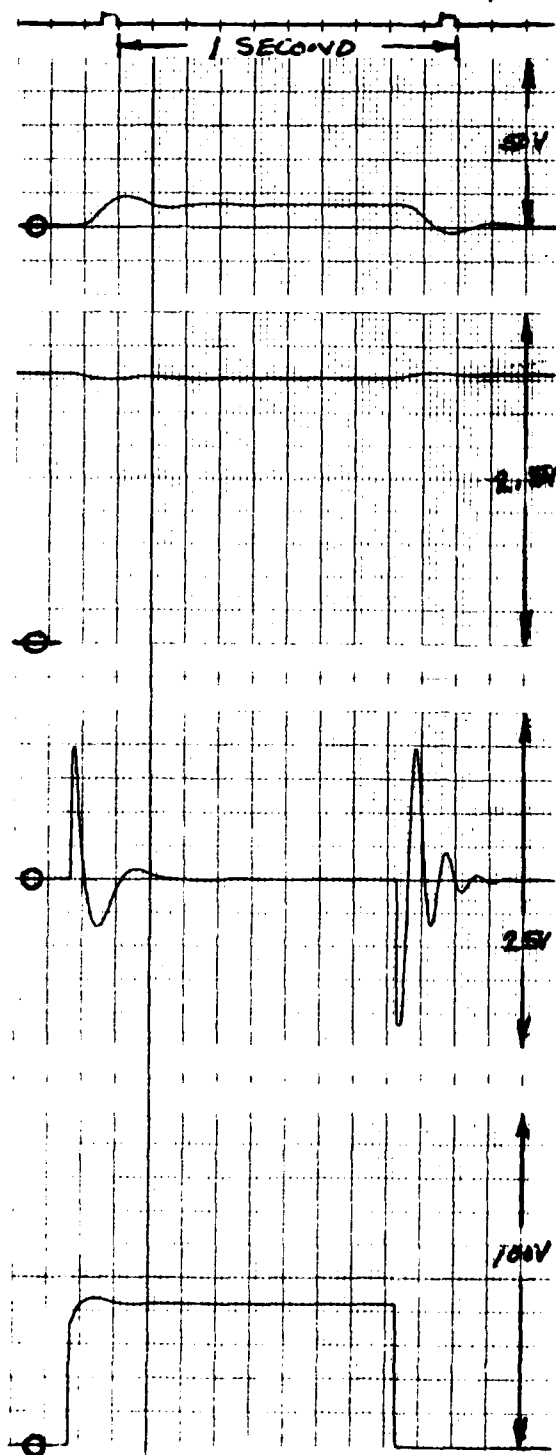
$$\frac{I_\ell}{2}$$

Figure 4-8.   Alternator 15% Inherent Regulation

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WITH FORWARD LOOP COMPENSATION

$$\frac{T_D}{50}$$

$$\frac{S\Theta_G}{100}$$

$$\frac{-\Delta E\ell}{2}$$

$$\frac{I\ell}{2}$$
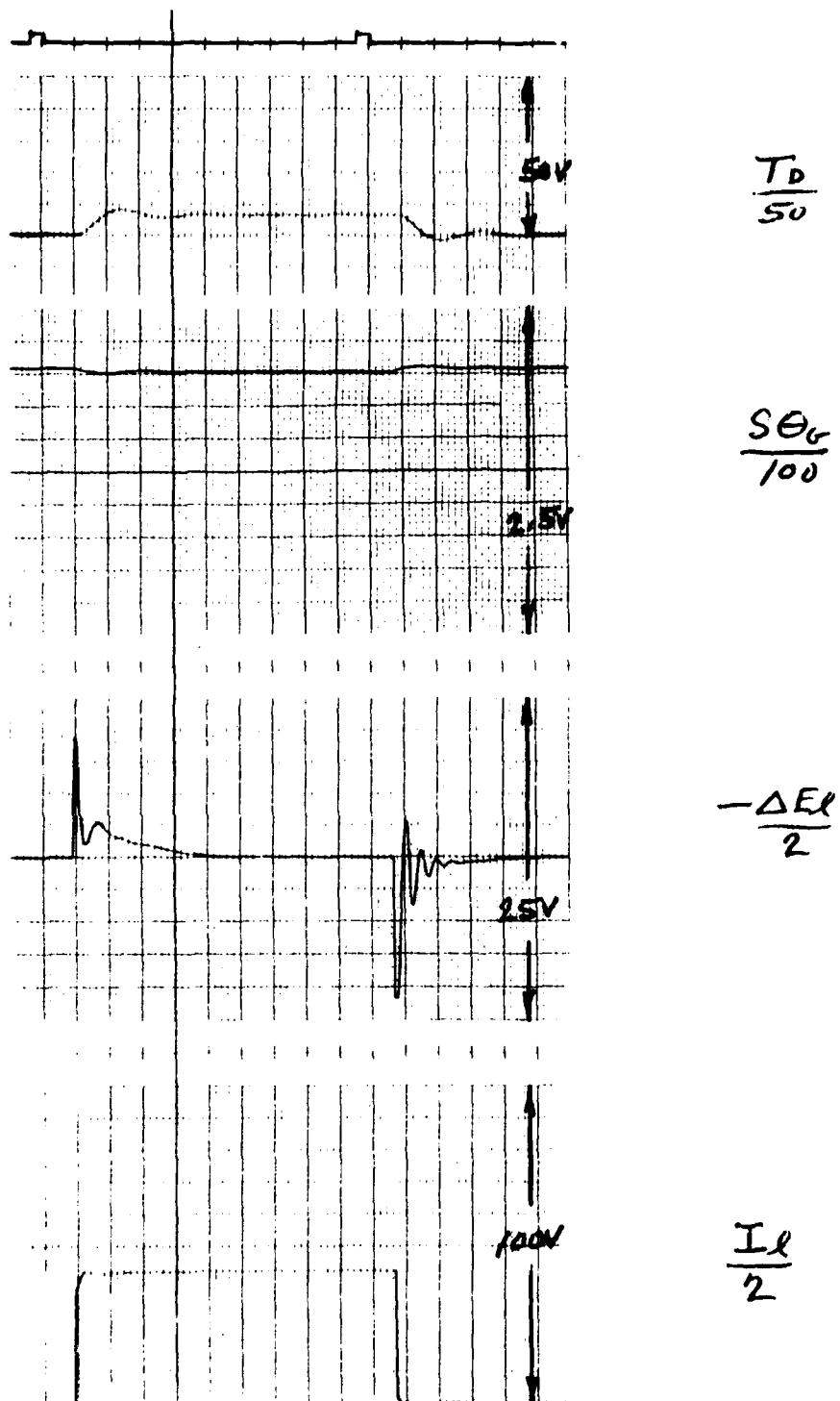
Figure 4-9. Alternator 15% Inherent Regulation

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OPEN LOOP TRANSFER CHARACTERISTIC

1) ALTERNATOR AND VOLTAGE REGULATOR

2) ALTERNATOR AND VOLTAGE REGULATOR WITH COMPENSATION

NETWORK

LEAD 3.34 HZ
LAG 13.7 HZ

PHASE SHIFT IN DEGREES ϕ

M IN DB

FREQUENCY IN HZ
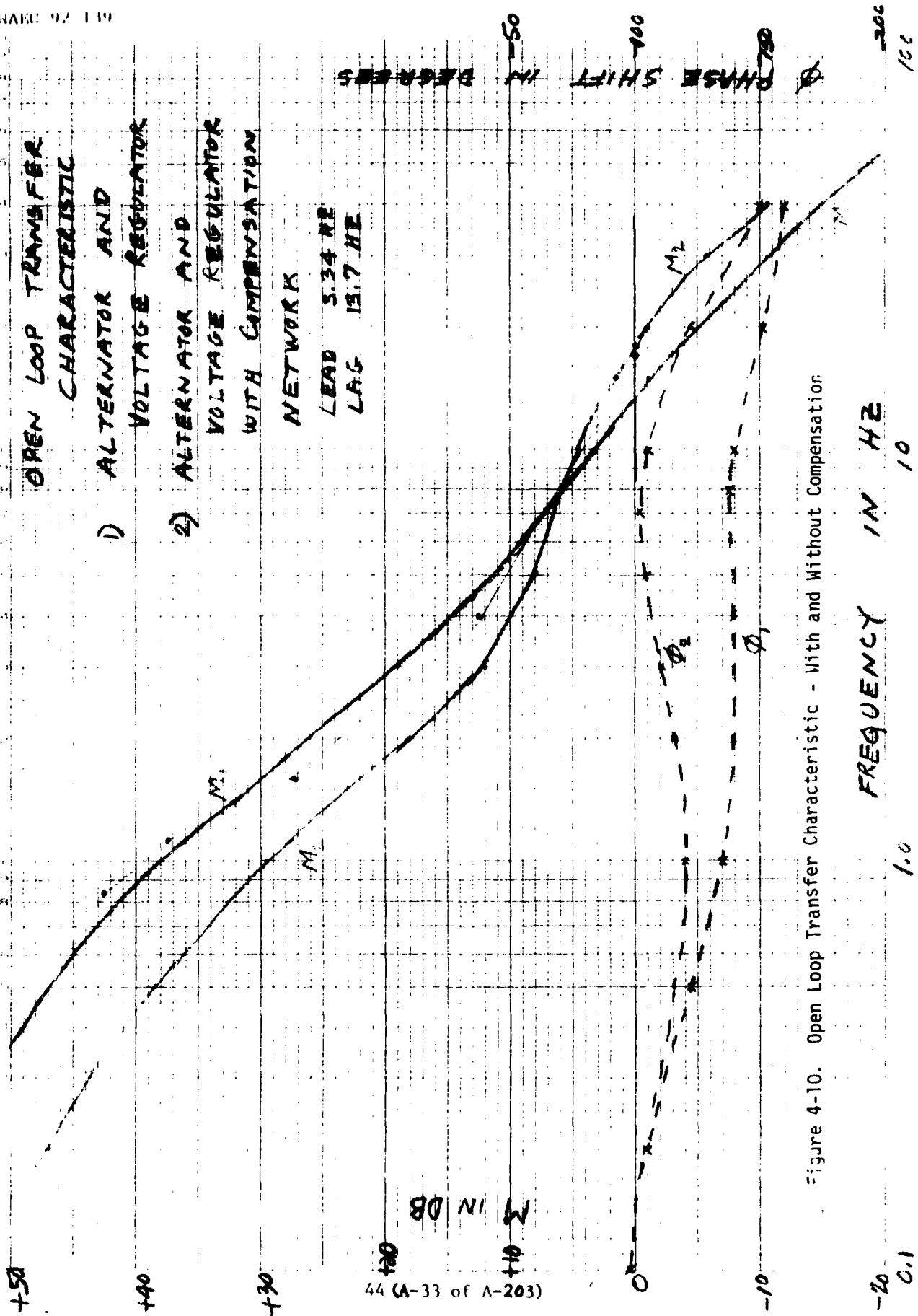
Figure 4-10. Open Loop Transfer Characteristic – With and Without Compensation
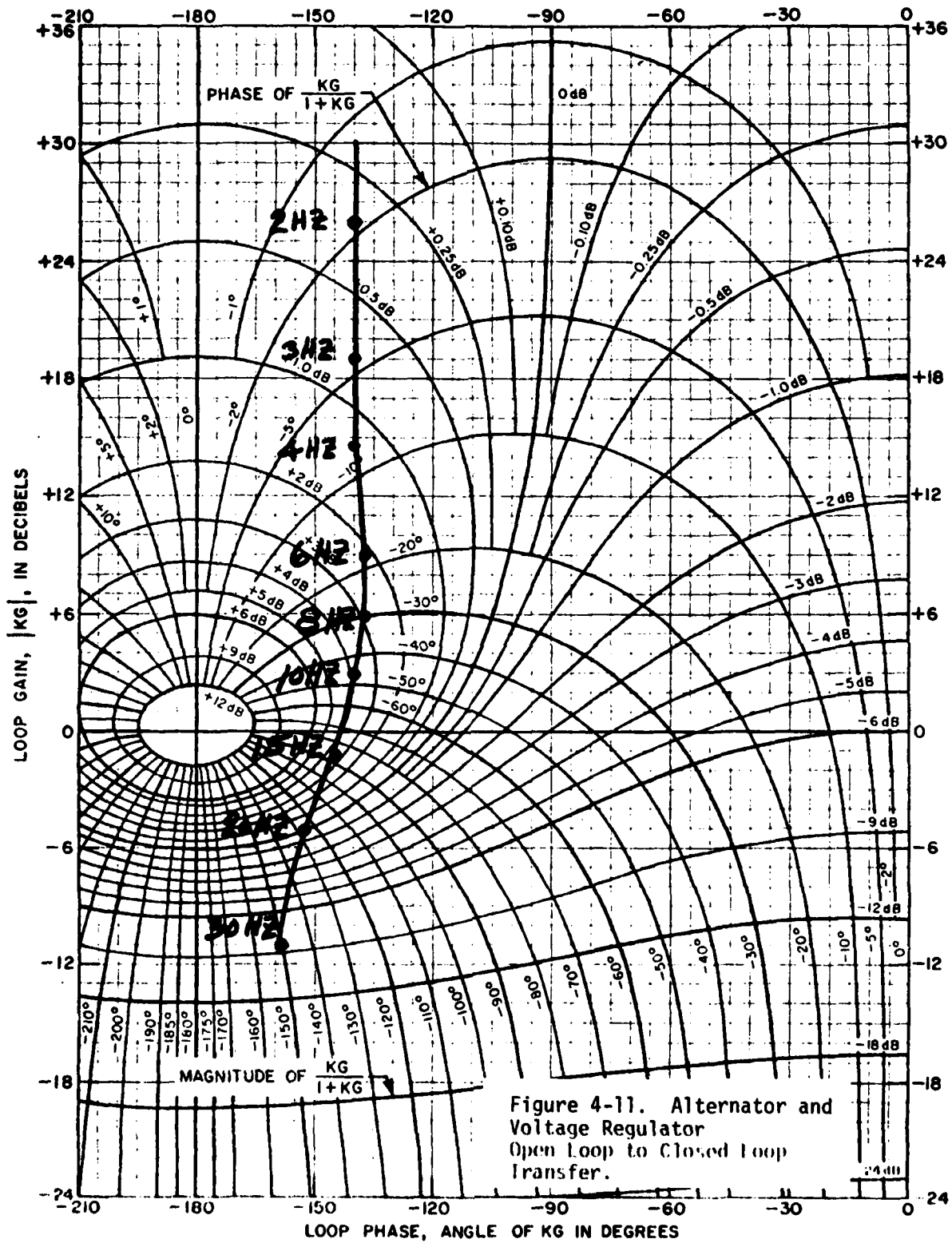
Figure 4-11. Alternator and Voltage Regulator Open Loop to Closed Loop Transfer.
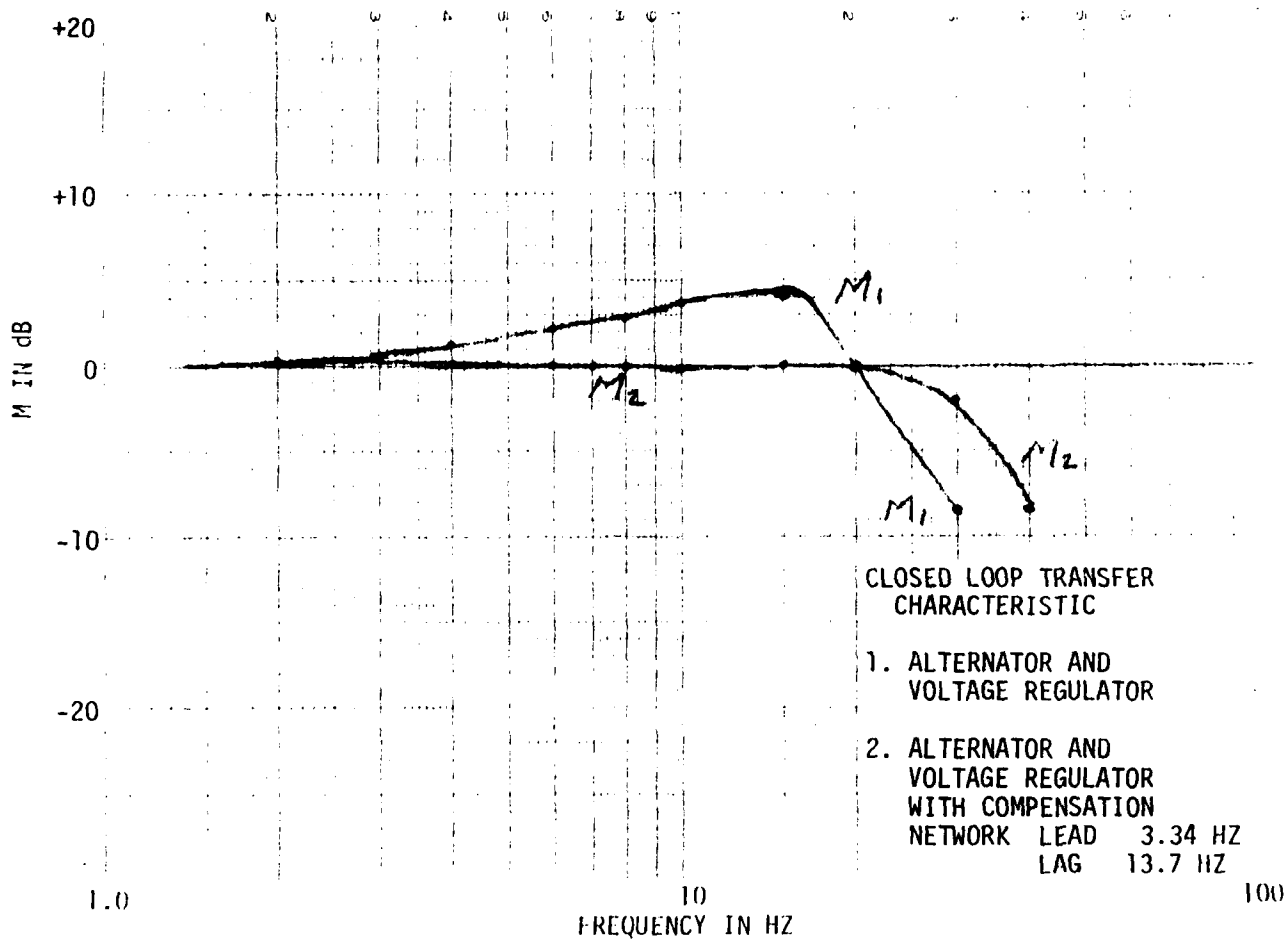
Figure 4-12. Closed Loop Transfer Characteristic,
With and Without Compensation

compensated system. The closed loop response is plotted in Figure 4-12 recorded as M_2 for magnitude versus frequency. The system has a characteristic of critical damping and a bandwidth that is flat to 20 Hz.

The analog computer runs that include non-linearities are found in 4-5 to compare with M_1 and in 4-7 to compare to M_2.

During the course of the study an investigation was made to determine the effect of different generator field time constants. It was found that increasing the time constant by a factor of 3 had a minimal effect on system performance when compensation networks were used. Close to the same bandwidth could be achieved using linear system analysis. The characteristics of the open and closed loop frequency response for this system are shown in Appendix D.

4.2.2 Analysis of Speed Regulation System

Most diesel engine governors are of the type zero system as illustrated in each of the analog computer programs. The best system for maintaining frequency control is a type one system. This system has been simulated on the analog computer as shown in Figure 4-14. An integrator has been added to make the governor a type one system. Considerable compensation is necessary to stabilize the speed control loop. Performance of this circuit is shown in Figure 4-15. It will be noted that under full load conditions the speed returns to no load speed after the transient period. No attempt was made at this time to optimize the control characteristic of the governor system with the integrator in the loop.

Such a system is commercially available from the Woodward Governor Company and is described in their Bulletin 37013, PSG Governor. A picture of this type of governor is shown in Figure 4-16 where the electric drive motor is the integrator between error voltage and throttle position.

4.2.3. Analysis of Voltage Regulation System

The strictly analog system is theoretically the best system as far as bandwidth of response since there is continuous signal with which to operate. Linear analysis techniques and compensation networks are easily calculated and fabricated.

A disadvantage is encountered when large currents such as field or exciter currents are controlled by analog methods. In the specific case
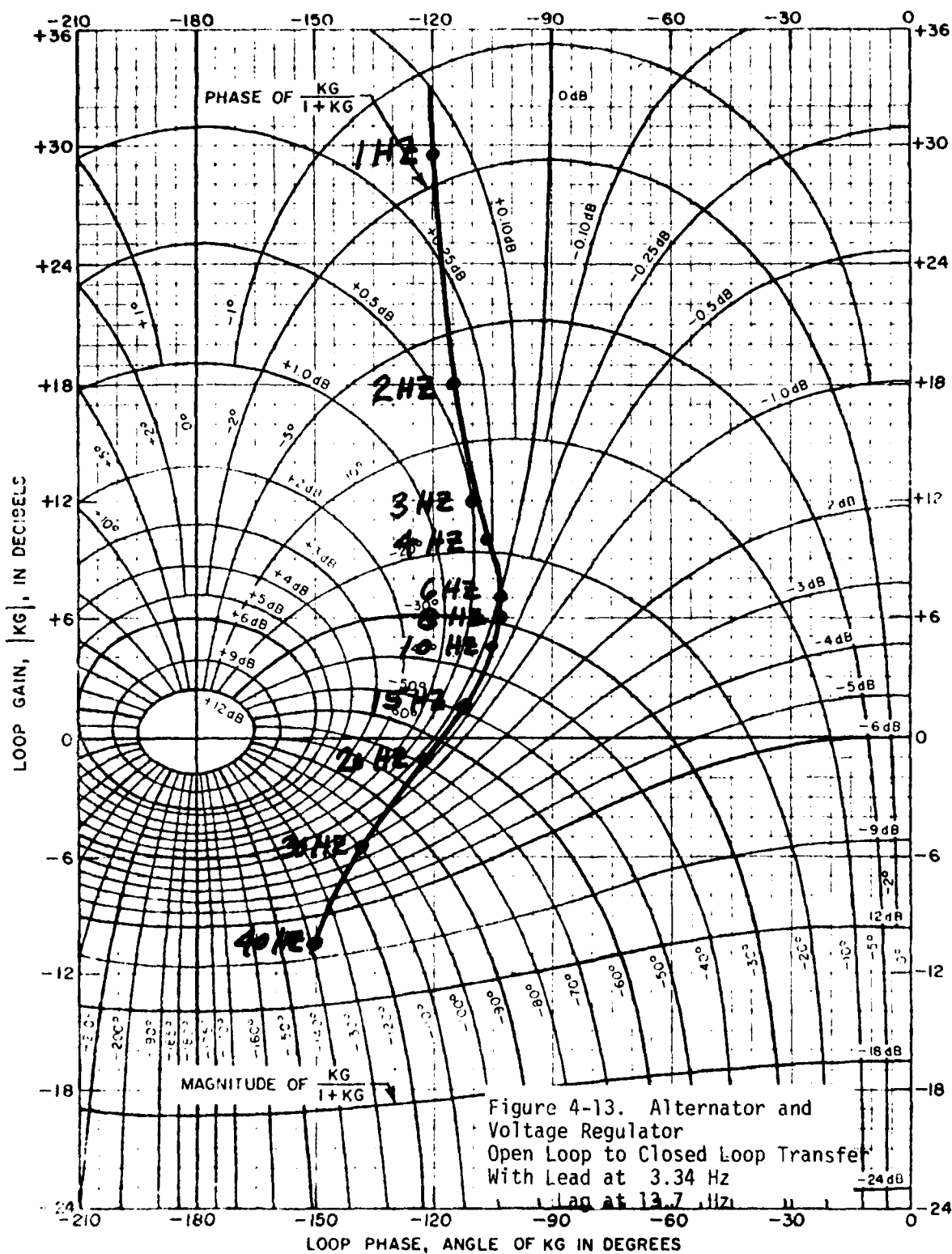
Figure 4-13. Alternator and
Voltage Regulator
Open Loop to Closed Loop Transfer
With Lead at 3.34 Hz
Lag at 13.7 Hz
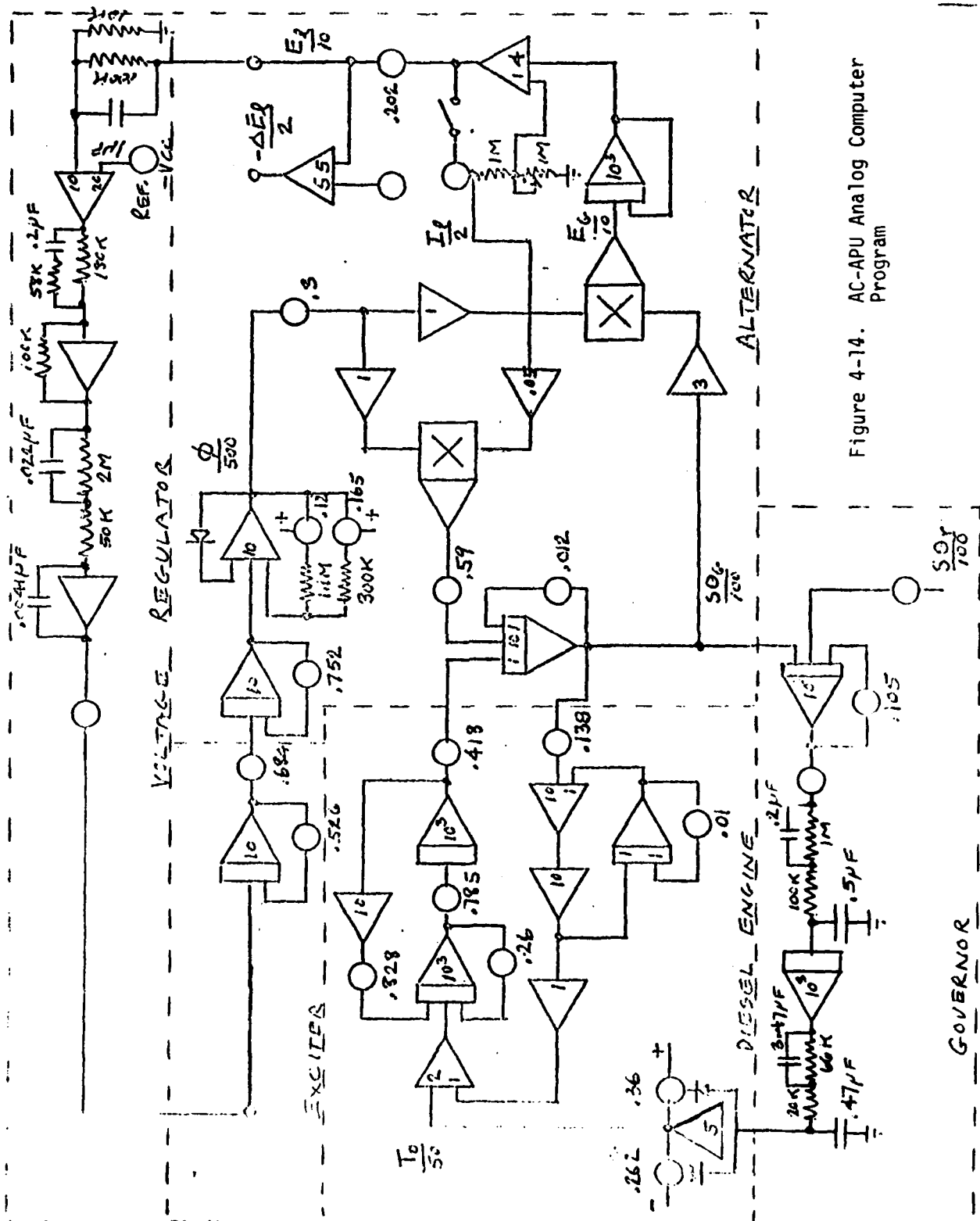
Figure 4-14. AC-APU Analog Computer Program
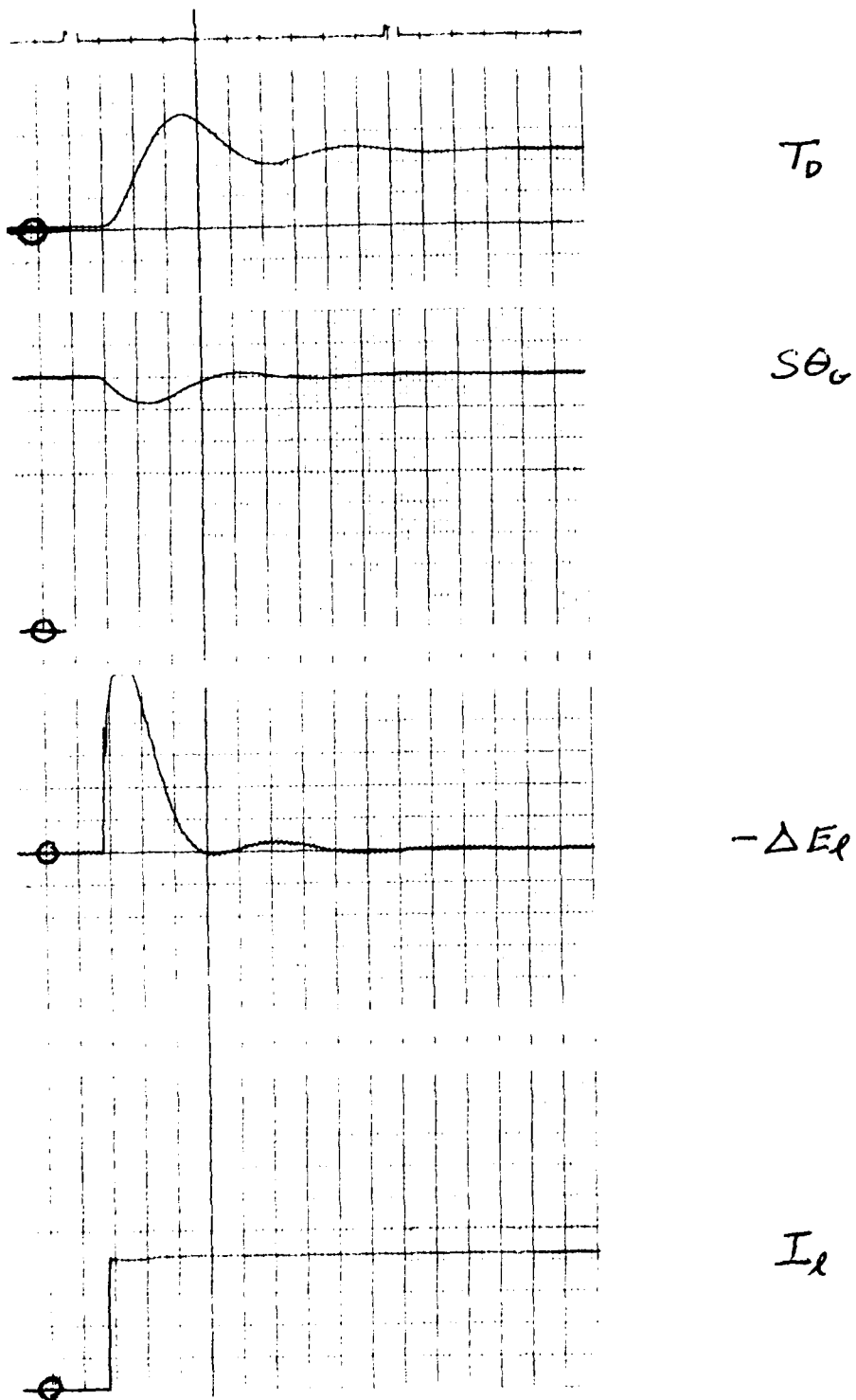
Figure 4-15.   Speed Regulator with Integrator

ELECTRIC
MOTOR
FOR SPEED
SETTING

KNURLED KNOB
FOR MANUAL
ADJ.

COVER

SUB
CAP

HIGH SPEED
STOP SCREW

VERTICAL
RETURNED
SPRING
HOUSING

OUTPUT
SHAFT

COMPENSATION
NEEDLE VALVE
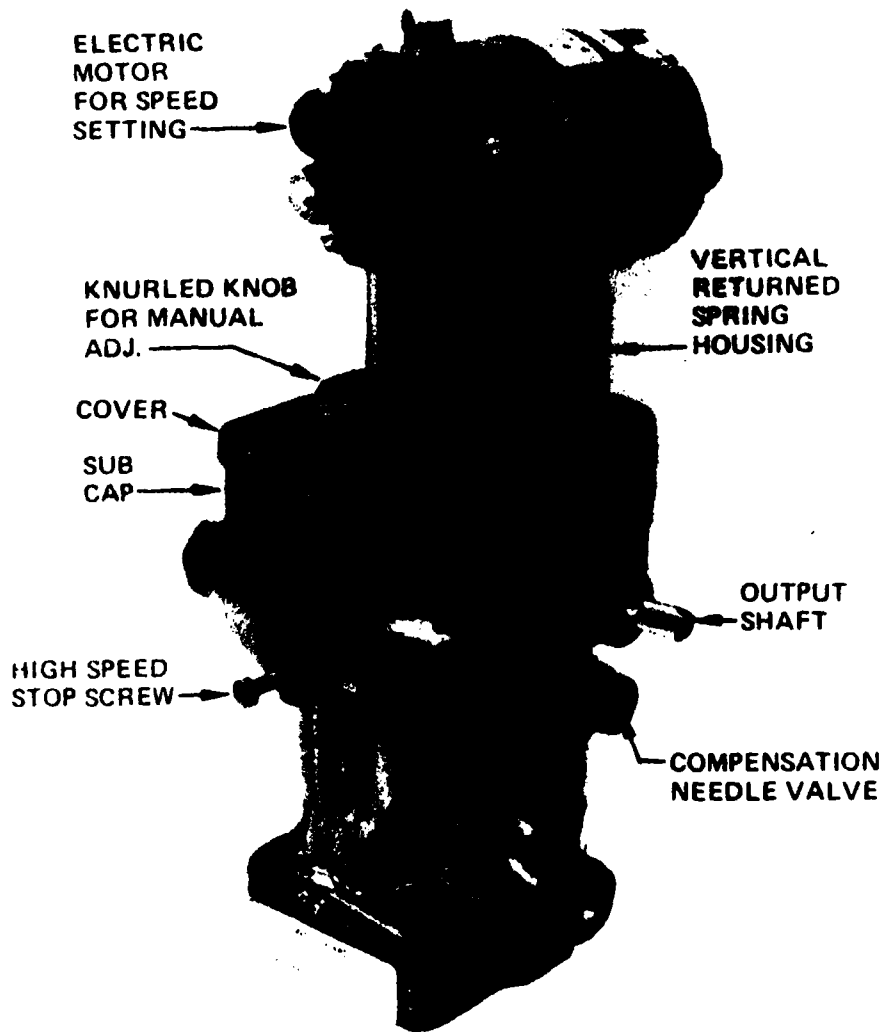
with Vertical Return Spring and Electric
speed Setting Motor.

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being studied, the exciter field is powered from a 28V DC source. Current
must be regulated from zero to 3.3 amperes for an output voltage of 120V
rms. The resistance of the field is 2.35 ohms thus making a maximum cur-
rent capability of 28/2.35 = 11.9 amperes. In Figure 4-17 we have plotted
load current to the exciter versus power dissipated in the series element.
At the no load operating point, the power to be dissipated in heat is equal
to:

$$P_D = [28 - I_{ex}(2.35)] \ I_{ex}$$

$$P_D = (28 - 7.755) \ 3.3$$

$$P_D = 66.8 \ watts$$

4.3 DIGITAL METHODS

The basic regulation methods selected for study were the NAVAIR Design,
bang-bang, multi-level bang-bang, direction sensitive multi-level bang-
bang and the digital simulation of analog designs. The actual implementa-
tion of many of the digital techniques provided great insights into the
problems and advantages of the various techniques. However, none of the
methods were developed to an optimal state.

4.3.1 Test Bed for Digital and Hybrid Techniques

The digital and hybrid regulation techniques were tested in real time
through the use of the combination of the digital and hybrid computers.
The bang-bang techniques were programmed into a PACER 100 digital computer
via analog to digital (A/D) and digital to analog (D/A) converters. The
PACER was used as a regulator for the analog computer motor generator simu-
lation. A block diagram of the system is presented as Figure 4-18.

The PACER provides a conservative comparison to existing microcomputer
systems in that:

> A. Its cycle time (1 μs) is fairly typical of microcomputer
> systems, and is, in fact, slower than many current micro-
> computer systems. For example, the XECON SMC360 has a
> typical instruction cycle time of 120 nonoseconds.
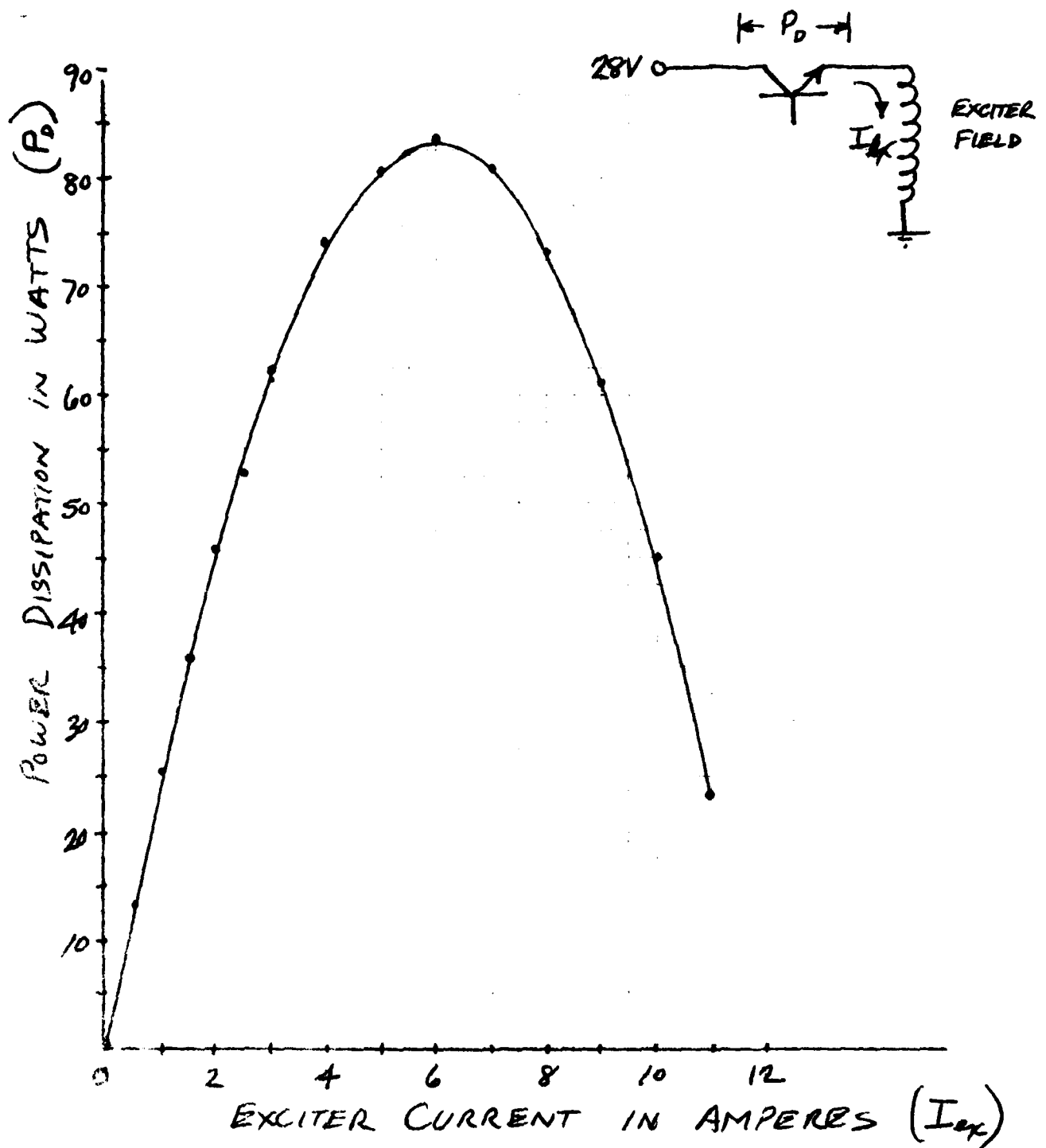
Figure 4-17. Power Dissipation in Exciter Field Control

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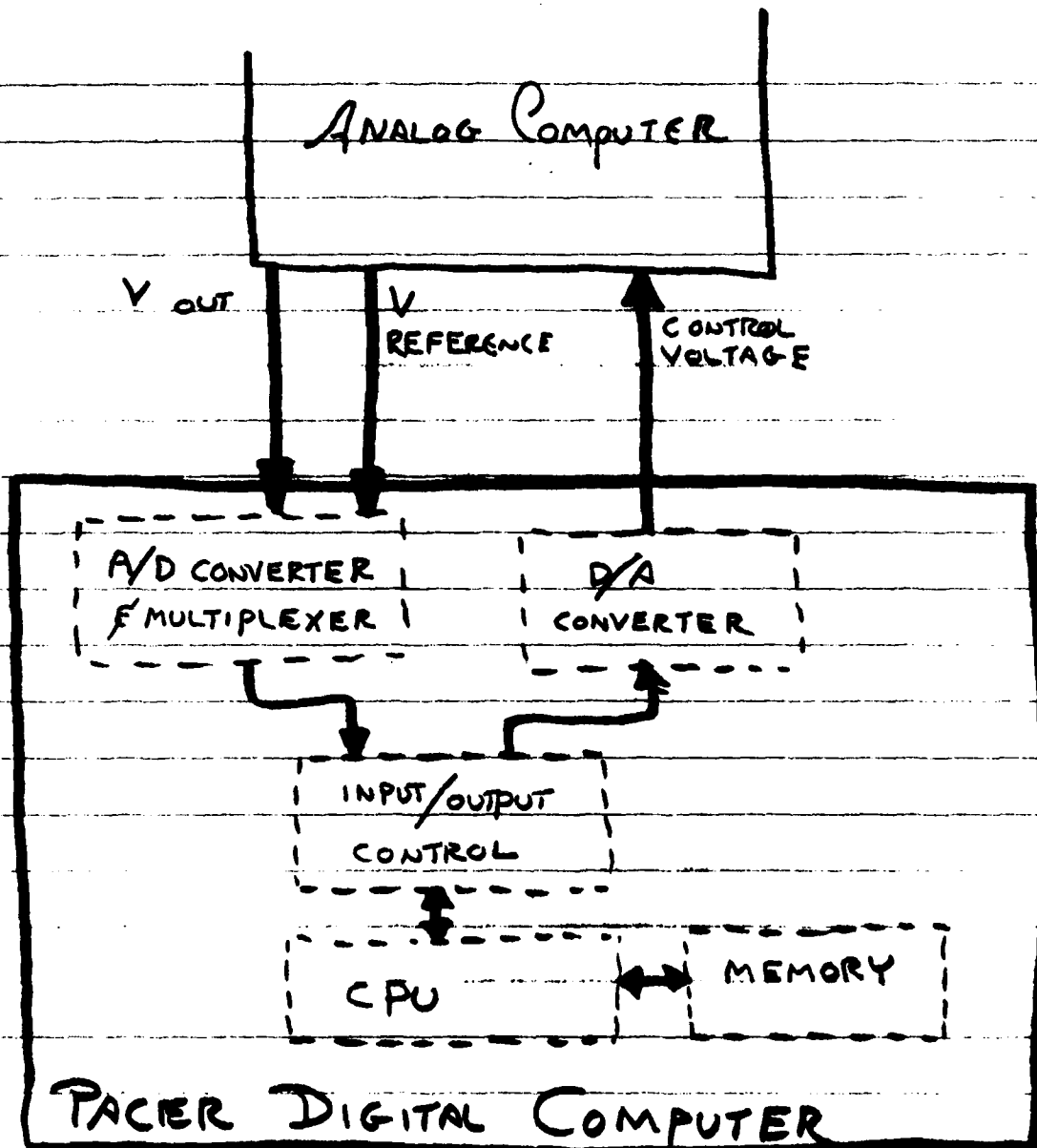
Figure 4-18.   Block Diagram of Digital Computer Controller

B. While the PACER is basically a 16-bit machine, its A/D and D/A are 8-bit devices. Thus, all data manipulation is handled in bytes of 8 bits--the same as most microcomputers.

C. The PACER instruction set contains 84 basic instructions, fewer than most microprocessors. For example, the Digital Equipment Corporation's KD11F microprocessor uses 400 basic instructions.

The PACER assembly language program for the general bang-bang techniques is presented as Appendix C. A basic flow chart of the program is presented as Figure 4-19a. This flow chart represents the multi-level bang-bang (to be described in Section 4.3.4) with provisions for switching in a parallel regulator when the output voltage is within programmed limits. Variations of this basic flow chart and of the program are used to perform the different bang-bang techniques.

4.3.2 NAVAIR TECHNIQUE

The first digital method to be considered is that of a comparator operating on the integrated error output of the voltage regulator system. This is similar to the system described in the NAVAIR report 19-45-19, Figure 1-13, AC Voltage Regulator, Schematic Diagram. In this system the voltage sensed is 3-phase half wave rectified. A lead network in the voltage feedback to the summing junction provides the ripple frequency to turn the comparator on and off. Since the analog computer simulation is a D.C. equivalent of the A.C. voltage, the ripple frequency will not be present and the on-off cycle is, therefore, dependent upon the control loop time constant. This is verified in the several runs made for this system on the analog computer with various compensating networks.

The first digital control technique is shown in Figure 4-20. The driving pulses are from full positive to full negative thus forcing the exciter input in either direction. This is somewhat similar to using a diode around the exciter field to force the field to collapse at a high rate. The performance of this system is shown in Figure 4-21 where the adjustable gain has been set to provide optimum results. The response does have a switching rate of about 28 Hz with a peak to peak amplitude of 2.5V. This is within the allowable voltage band for transient operations.

55(A-44 of A-203)
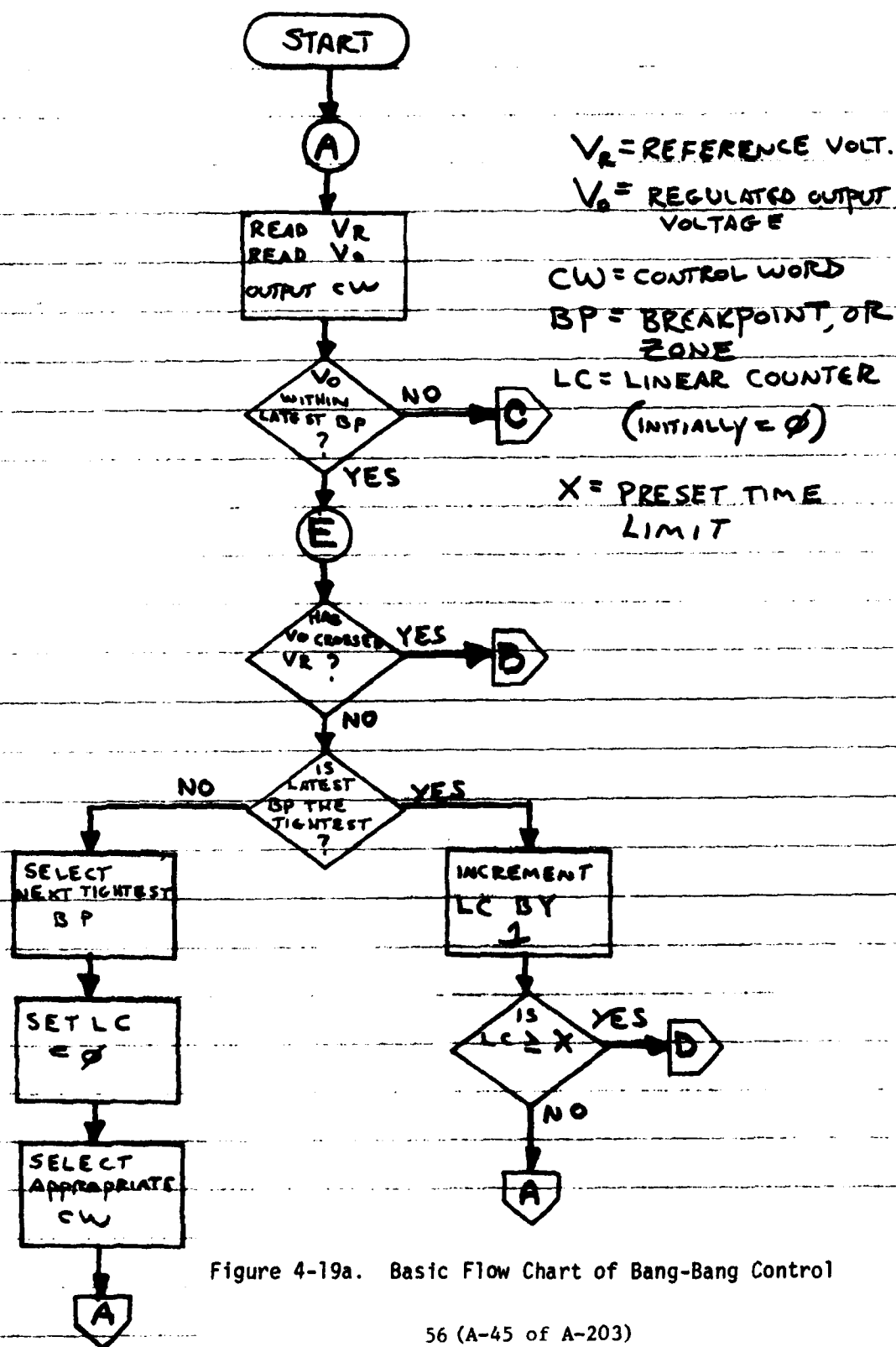
Figure 4-19a.   Basic Flow Chart of Bang-Bang Control

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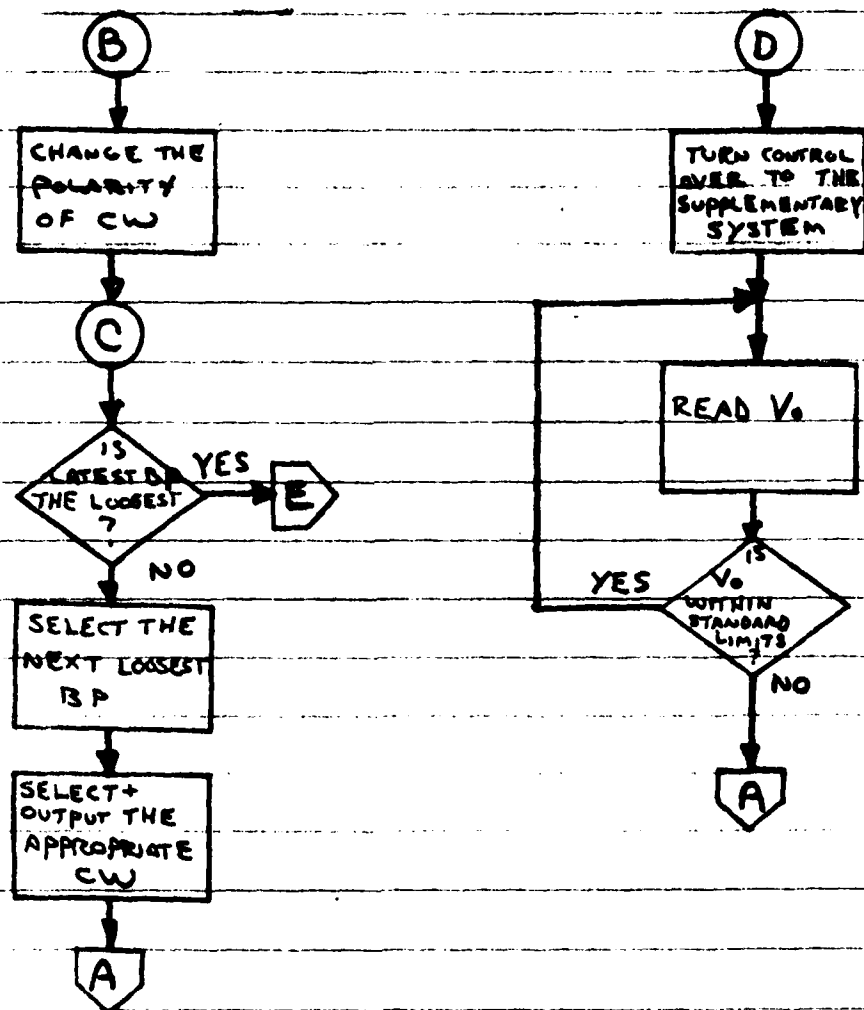
Figure 4-19b. Basic Flow Chart of Bang-Bang Control (Continued)
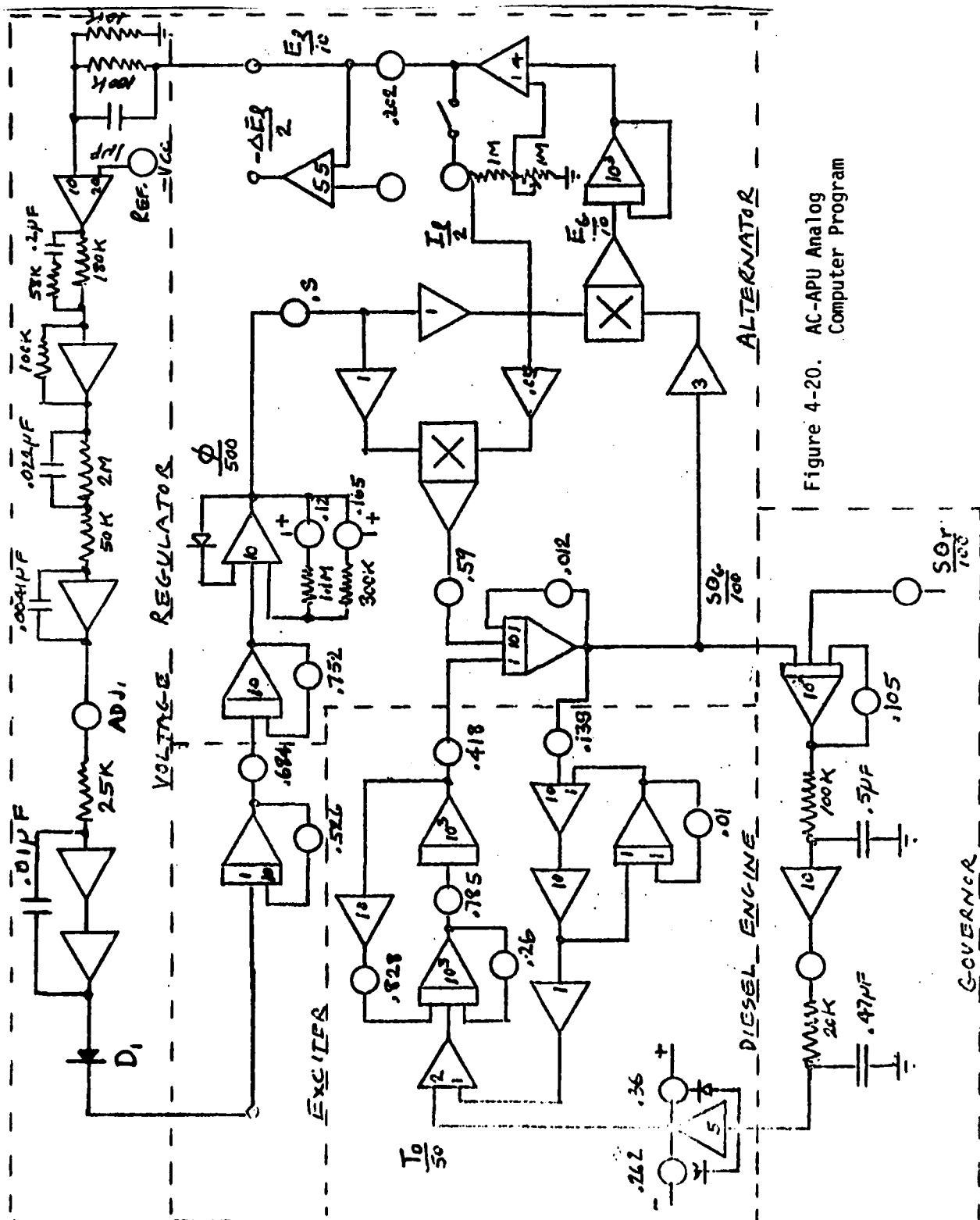
Figure 4-20. AC-APU Analog Computer Program

$$\frac{T_D}{50}$$

$$\frac{S\Theta_G}{100}$$

$$-\Delta\frac{E_\ell}{2}$$
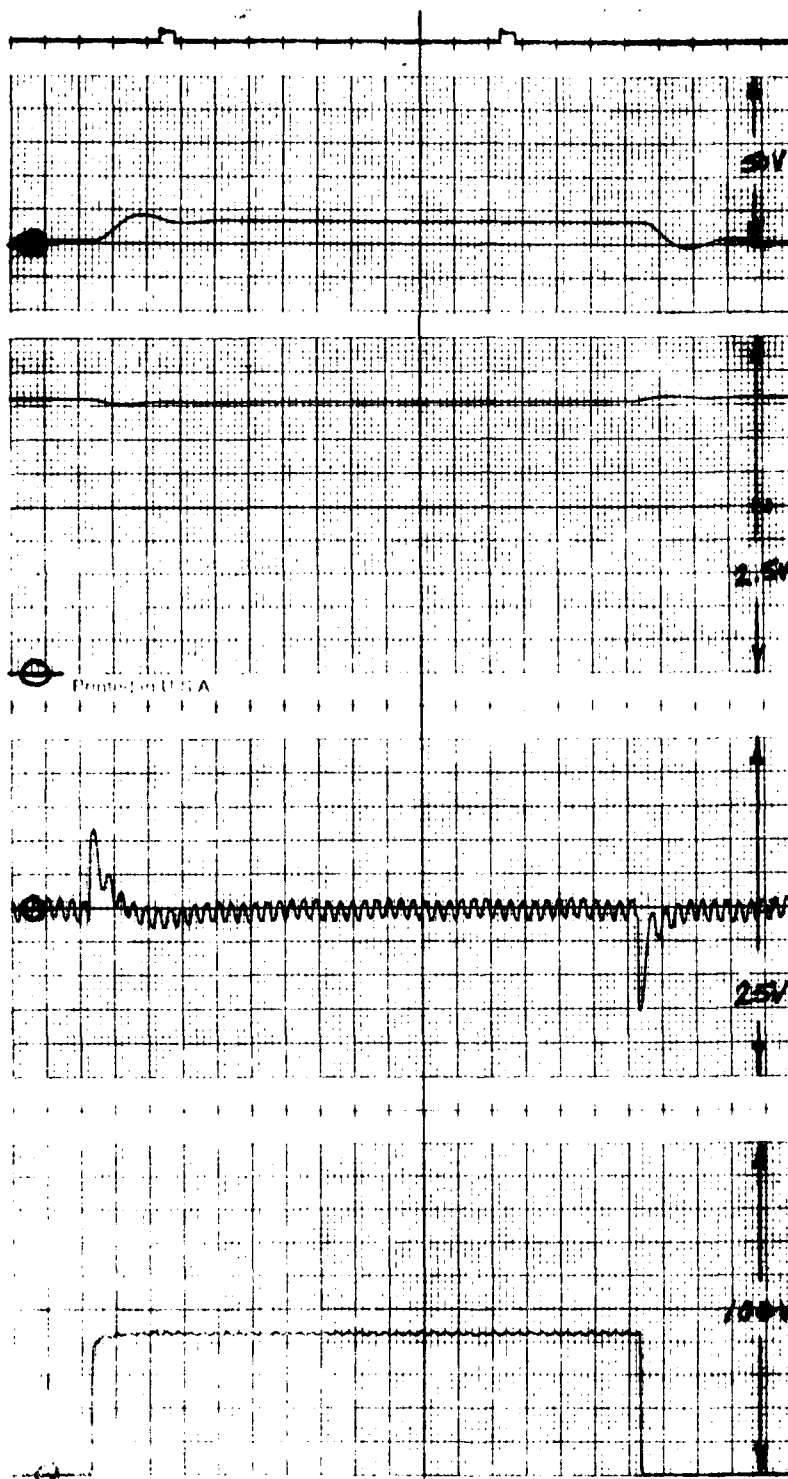
$$\frac{I_\ell}{2}$$

Figure 4-21. B1 Directional Comparator Control

The same system was simulated with the exception that a single direction of driving current pulse was permitted in the exciter field. This circuit is shown in Figure 4-22 where the diode D_1 has been added. The performance characteristic is shown in Figure 4-23 where it is evident that the voltage regulation is outside the allowable range during transient but just fits within the range during constant load. The switching rate is about 14 Hz which agrees with the anticipated response being twice the time period due to only unidirectional pulse modulation of the exciter current.

A higher loop gain would permit faster operation of the comparator circuit and decrease the load voltage excursion. The high frequency range of the system was increased by adding a lead compensation between the comparator and the exciter field input. In actual hardware this can be incorporated in the base of the transistor used to drive the field current. This circuit is shown in Figure 4-24. The performance of the circuit is shown for two values of capacitance C_1 with optimum gain settings. Figure 4-25 is the response when $C_1 = .047$ μF. Pulse modulation is evident in the recording of the exciter input voltage. The response is too slow and the transient falls outside the allowable limits. The constant load condition shows a clean and steady voltage level. A compromise is reached when $C_1 = .01$ μF and the gain adjusted for optimum performance as recorded in Figure 4-26. The switching rate is approximately 42.5 Hz and the response does fall within the constant load and transient envelope of performance requirement. The amplitude of load voltage ripple is approximately 1.2 volts peak to peak.

4.3.3 NAVAIR Design Analysis

In the NAVAIR system, a comparator is used to pulse width modulate the current delivered to the exciter field. This system has considerably lower losses since the series element is either fully saturated or completely cut off. The power dissipation is limited to the rise and fall time versus the repetition rate. As an approximation if the rise time is 10 microseconds and the repetion rate 1000 Hz, then the heat dissipation

Figure 4-22.   AC-APU Computer Program
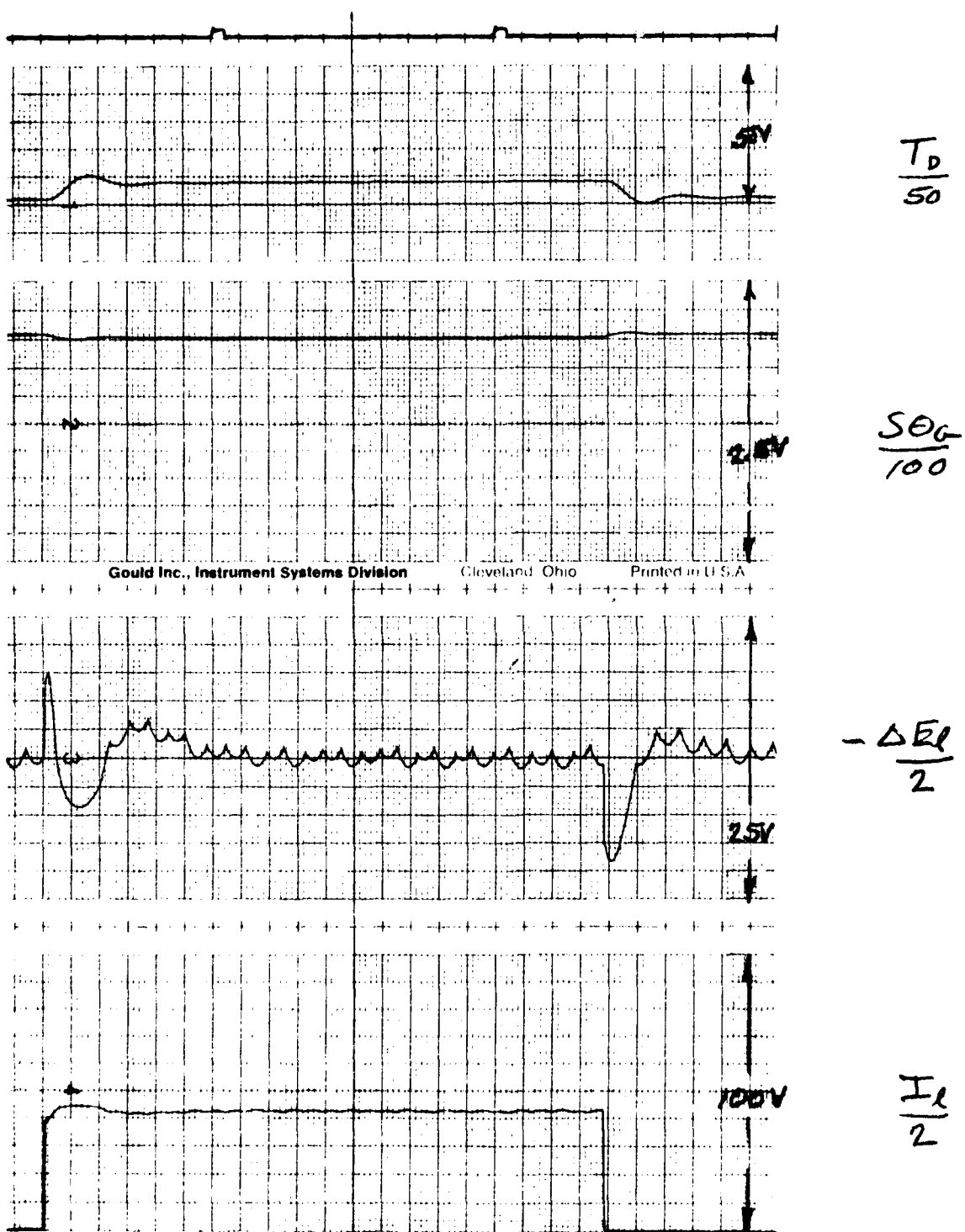
Figure 4-23.   Uni-Directional Comparator Control
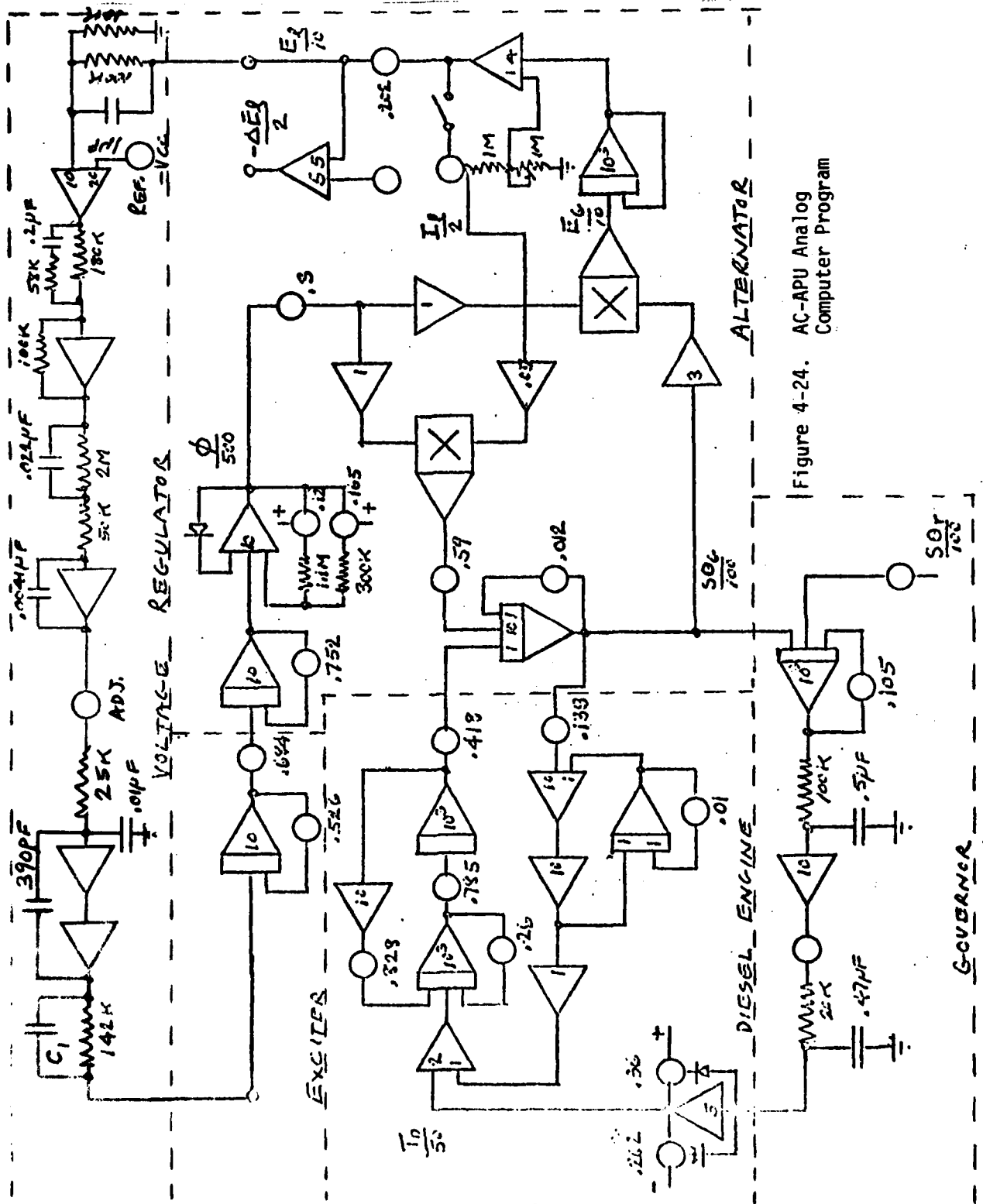
Figure 4-24. AC-APU Analog
Computer Program

$$C_1 = .047 \mu F$$

EXCITER
INPUT

500V

$-\Delta \dfrac{E\ell}{2}$

25V

$\dfrac{I\ell}{2}$

100V
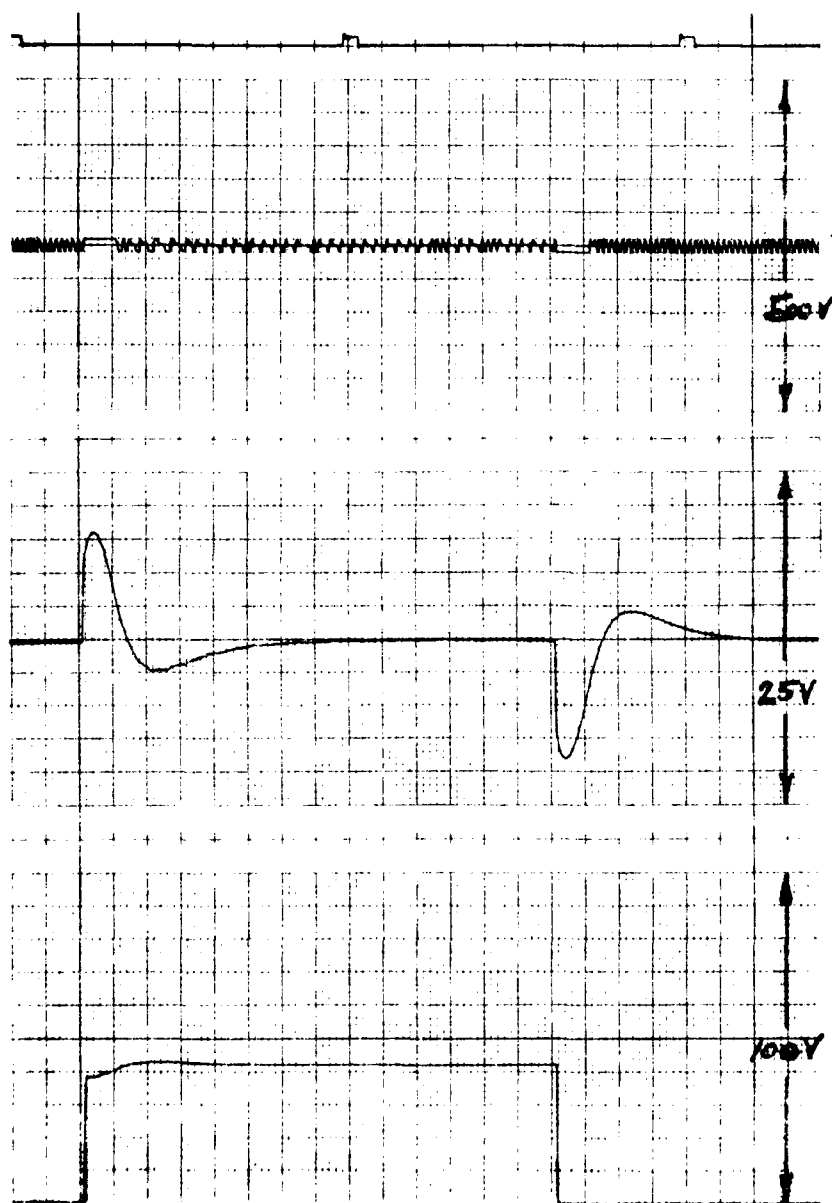
Figure 4-25. Bi-Directional Comparator with Compensation #1.

$$C_1 = .01 \mu F$$

EXCITER
INPUT

$-\Delta \dfrac{E\ell}{2}$
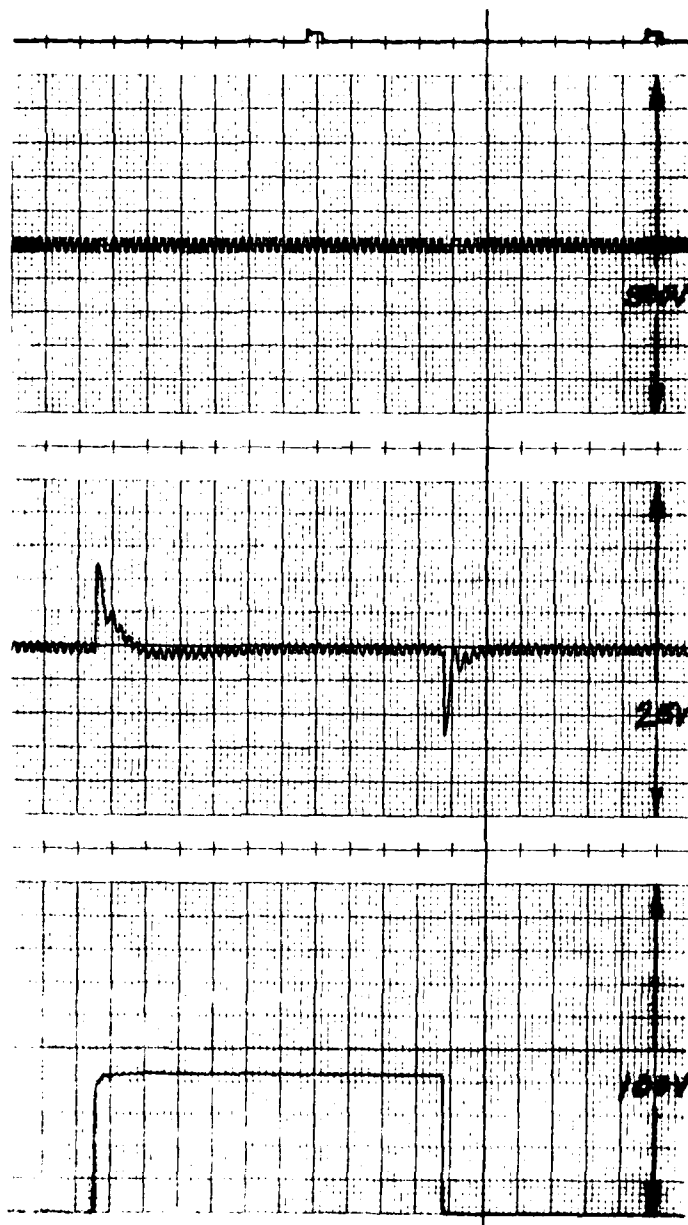
$\dfrac{I_\ell}{2}$

Figure 4-26.   B1 Directional Comparator with Compensation #2

would be in the range of:

$$P'_D = (\frac{2 \times 10 \times 10^{-6}}{10^{-3}}) \ 80 \times .636 = 1.018 \text{ watts}$$

This is a considerable reduction in the heat dissipation problem.

The switching rate of the comparator is dependent upon either ripple frequency of the load voltage or the system time constants. For the AC application the ripple can be obtained from the rectified load voltage as in the design shown in the NAVAIR report 19-45-19, Figure 1-13.

4.3.4 Bang-Bang

A bang-bang controller operates by monitoring the output voltage of the motor generator set and depending on the value of the voltage calls for either maximum or minimum field current. This is similar to the NAVAIR design. For example, if the output voltage should be equal to 10 volts but is actually equal to a value above 10 volts, the controller will reduce the voltage by setting the field current to the minimum. If the output falls below 10 volts, the controller responds by setting the field current to the maximum level. In this way the controller switches on or off in an attempt to maintain a constant output voltage level.

The rate of this on-off switching is a function of current demands and the switching level of the controller. If for example, a sudden current demand is placed on the motor generator, the voltage will tend to fall, and the controller will respond by holding the field current at maximum until the voltage recovers. The chief advantage is that, in the optimum design, the recovery time is minimized because the field current is maximized.

The switching level of the controller is the level at which the controller recognizes that the voltage is too high or too low. Normally, the off level is V + h and the on level if V - h, where V is the desired output and h is a small preset voltage level. This is also known as hysteresis. The smaller the h, the faster the controller will respond to variations in V by switching the field current.

In the computer program the bang-bang system was implemented by using one break point (output voltage was either above or below the reference) and two control words (the field current was switched between full on and full off). The program was also modified so that the parallel regulator was never switched in; thus, the pure bang-bang effect was obtained.

4.3.5 Analysis of Bang-Bang Technique

The major problem with the pure bang-bang system as implemented was oscillation of the regulator's output voltage. The bang-bang decision (to switch from high field current to low field current) was based on the relationship of the output voltage to the reference voltage. When the output voltage was greater than the reference voltage, the field current control was set to the low value; when output was less than the reference, the field current control was set to the higher value. However, the momentum of the output voltage is such that about .05 seconds, after the bang-bang level has been applied, is required to reverse direction. Figure 4-27 presents an example of the oscillation. This effect may be eliminated or minimized by a number of methods. One such method is to optimize the gain of the control signal to the field current. This would reduce the time to reverse the momentum of the voltage and thus reduce the amplitude of the oscillation.

The bang-bang scheme could be performed by a microcomputer in a time sharing mode with the display and diagnostic routines. It is estimated (based on the PACER) that a computer could perform the diagnostic and display routines and still make bang-bang decisions at speeds in excess of 1 KHz.

The hardware required, in addition to that already assumed for display and diagnostics, would be as little as the dedication of one digital output line for the control signal, dedication of one A/D multiplexer channel for reading to regulator output voltage, use of approximately 100 words of memory, and the addition of a field current driver circuit. In actual hardware dollars this would be about $100.
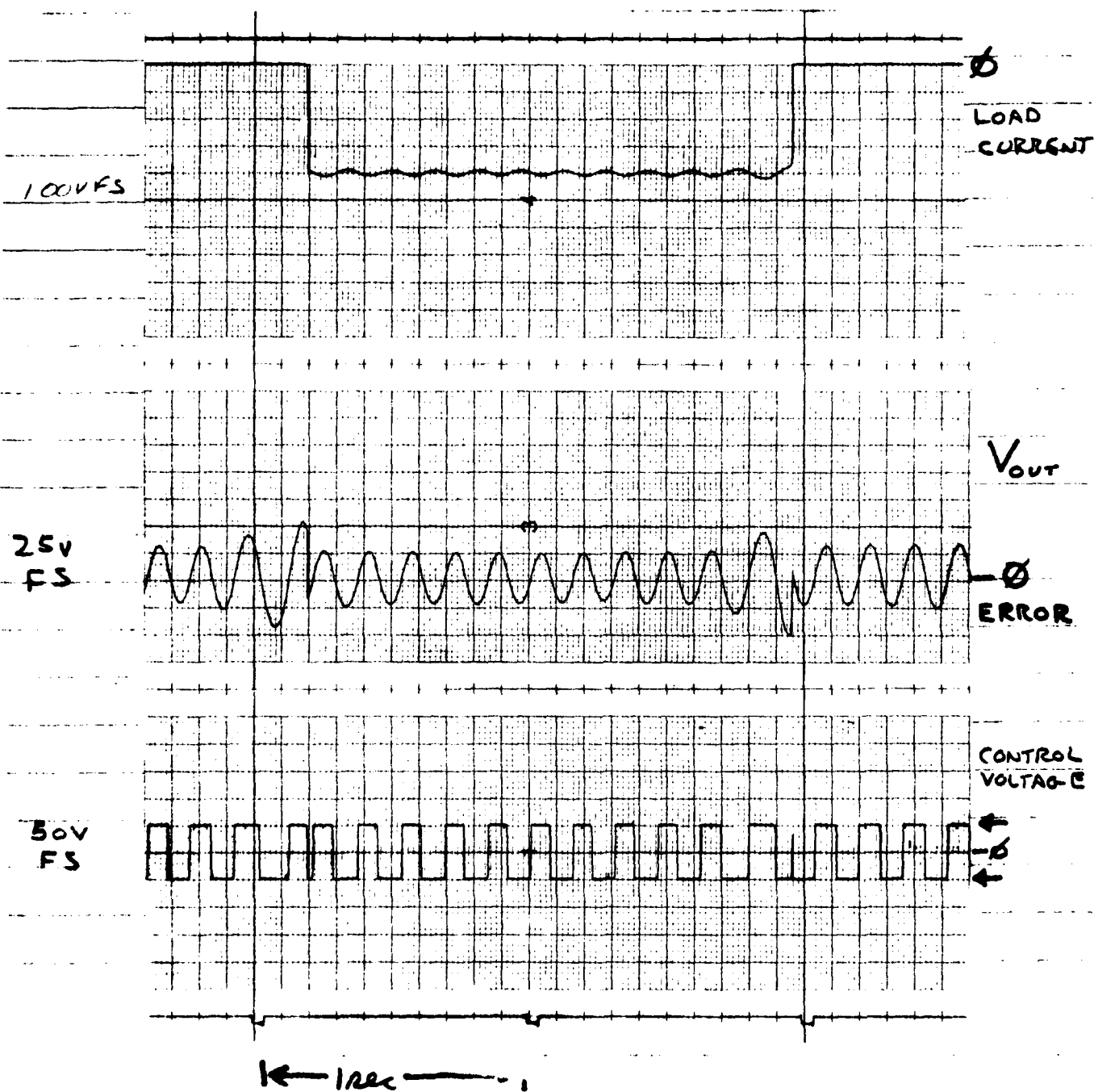
Figure 4-27.   An Example of V_{out} Oscillations Occurring with
Bang-Bang Control.

4.3.6 Multi-Level Bang-Bang

Multi-level bang-bang (MLBB) operates in a manner similar to pure bang-bang except the controller does not simply turn the field current on or off. The controller sets the field current to a level dependent on the difference between the actual output voltage and the desired output voltage. The chief advantage of this method is that, optimally, it combines the fast recovery of bang-bang with the smooth operation of a linear circuit.

The control can be described as a look-up table. Given the output voltage, the table indicates the field current setting for best regulation. An example of a look up table is presented as Figure 4-28. Referring to the figure, if the desired output voltage was 10 and the actual voltage was 18 volts, the field current would be turned off; if the output voltage was 1, the field current would be turned completely on. The operation as described so far is identical to pure bang-bang. However, if the output voltage were 7.5, the field current would be set to 60% of full scale; a reading of 16V will result in a field current setting of 10% of full scale, etc. Since a digital computer is programmable, any voltage breakpoint and field current value could be assigned and modified without effecting the hardware. Ideally, the optimum values would be selected for the regulator.

In the computer program, the multilevel bang-bang system was implemented as described--through the use of a look-up list. The computer stored a list of breakpoints. These breakpoints represented zones above and below the reference voltage. Each breakpoint or zone had a corresponding control word. The control word represented the desired field current to be supplied when the output voltage was within the zone.

4.3.7 Analysis of Multi-level Bang-Bang Techniques

A reduction in the amplitude of the output voltage oscillation was achieved by switching from pure bang-bang control to the multilevel bang-bang (see Figure 4-29).

Most of the hardware required for MLBB is identical to that used in pure bang-bang, the major exception being the field current driver. In the

OUTPUT VOLTAGE RANGE*	FIELD CURRENT % OF FULL ON
20 TO 17.0	0
16.9 TO 14.0	10
13.9 TO 12.0	40
11.9 TO 9.0	50
8.9 TO 7.0	60
6.9 TO 4.0	90
3.9 TO 0.0	100

* IN THIS EXAMPLE, 10 VOLTS IS THE DESIRED
  OUTPUT VOLTAGE.

Figure 4-28.   An Example of a Look-Up Table for
              Multi-Level Bang-Bang Control
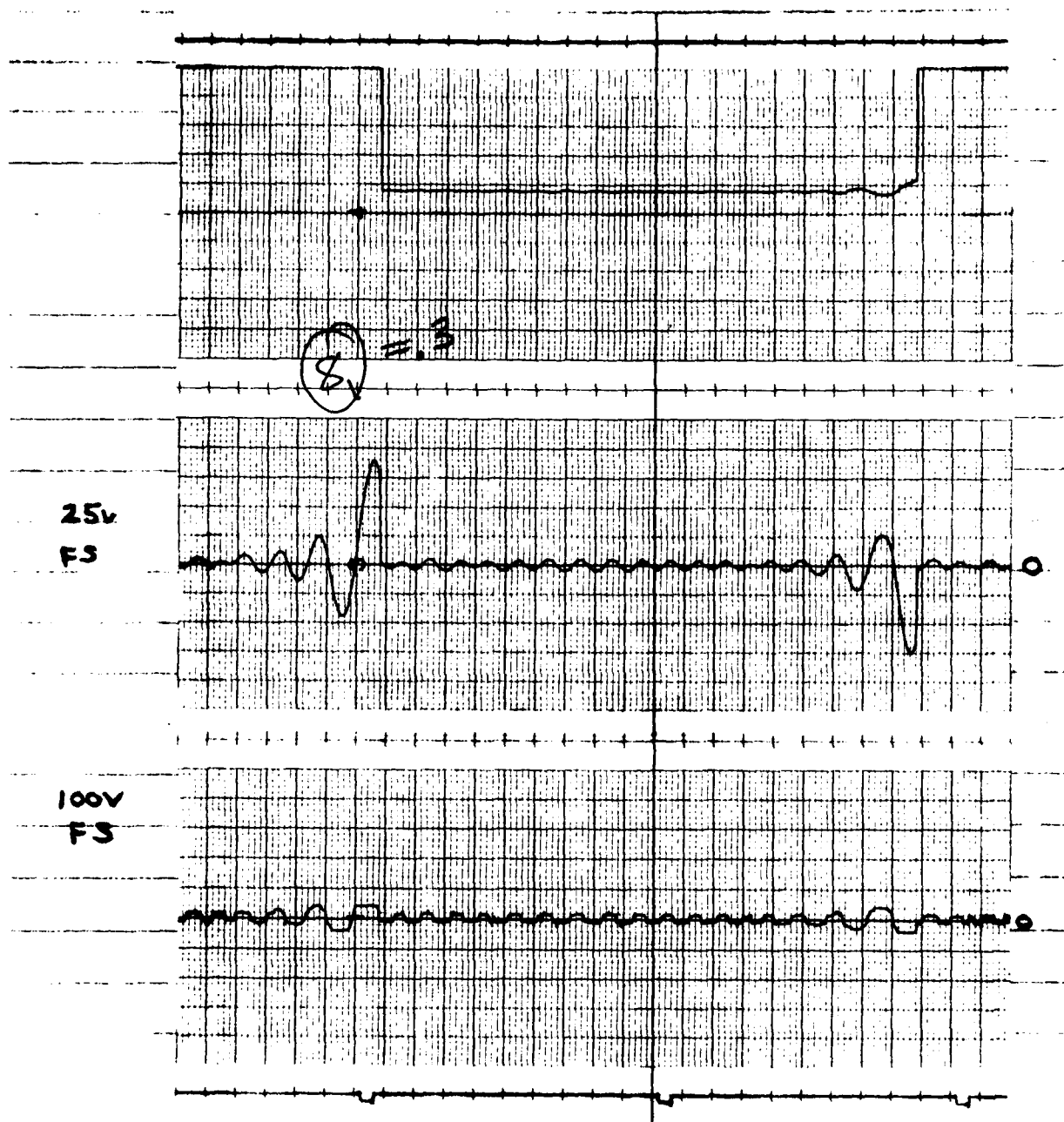
Figure 4-29.   An Example of Multi-Level Bang-Bang Control

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bang-bang case the driver can be a single saturating switch; however, in
multiple bang-bang the driver can be either a non-saturating driver or an
adjustable gain saturating driver. The non-saturating driver would be
less complex but also less efficient (more heat) than the adjustable gain
saturating driver.

The hardware cost of the saturating driver would be about $60 compared
to about $30 for the non-saturating driver. The other hardware addition
would be a requirement for about 200 more words of memory. The estimated
hardware cost of adding the MLBB with a saturating field current driver
is $150 (about $50 more than the bang-bang controller). MLBB would not
demand significantly more computer time than bang-bang. Therefore, the
controlling rate could still be in excess of 1 KHz.

4.3.8 Direction Sensitive Multi-Level Bang-Bang

Direction sensitive multi-level bang-bang (DSMLBB) is yet a further
extension of the basic bang-bang scheme. DSMLBB is similar to MLBB in
that the control is dependent on the difference between the desired and
actual output voltage. However, DSMLBB takes past events into considera-
tion by adding direction of the output voltage as a control parameter.

Continuing the example of a look up list, Figure 4-30 shows a list for
DSMLBB. Notice that the selection of field current depends on the direc-
tion of the output voltage. For example, if the voltage were sitting at
10V when a load was placed on the line, the voltage would tend to drop or
go down. If the voltage dropped to 5 volts, the controller would try to
recover by calling for full field current (100%). If the voltage began to
rise, to say 5.1 volts, the field current selection would be made from the
"up" column and would be 90%. As the voltage further recovered (8 volts)
the control would be selected from the charts "up" column.

Thus when the load is changed and the actual voltage is moving _away_
from the desired voltage, the control reacts quickly and applies a decisive
counter control; however, as the voltage begins to approach the desired
value, the control is such as to allow the voltage to recover with minimum
overshoot. Ideally, this system will rapidly control load transients with

OUTPUT VOLTAGE* ZONE	FIELD CURRENT % OF FULL ON	
	DIRECTION OF VOLTAGE	
	UP	DOWN
20 TO 17.0	0	0
16.9 TO 14.0	0	10
13.9 TO 12.0	10	40
11.9 TO 9.0	45	55
8.9 TO 7.0	60	90
6.9 TO 4.0	90	100
3.9 TO 0.0	100	100

* IN THIS EXAMPLE, 10 VOLTS IS THE
DESIRED OUTPUT VOLTAGE.

Figure 4-30. An Example of a Look-Up Table for the
Direction Sensitive Multi-Level Bang-
Bang Control.

a minimum overshoot.

The computer program to implement the DSMLBB scheme was an extension to the MLBB program. A subroutine was added to determine, at each occurrence of reading the output voltage, if the output voltage had changed directions (output voltage derivative zero crossing). If the direction had not changed control word for the zone would be read as in the MLBB program. However, if the direction of the output voltage has changed, the control word would be selected from another list.

4.3.9 Analysis of Direction Sensitive Multi-Level Bang-Bang

The MLBB experiments showed (Figure 4-29) that the particular design required over 300 ms to regulate after application of 100% load. DSMLBB was implemented in an attempt to reduce the settling time. Figure 4-31 presents a DSMLBB run in which the settling time was reduced to below 200 ms.

The only hardware difference between MLBB and DSMLBB is the addition of about 100 words of memory in the latter case. This comes to a hardware cost difference of about $10. The computer time requirements remain essentially unchanged.

4.3.10 Digital Simulation of Analog Designs

The digital simulation of an analog design consists basically of solving a differential equation in real time. The equation can be written from an existing analog design. The chief advantage of this method is that the regulation scheme can be modified in software without changing any hardware. This advantage may aid in creating a controller with a single hardware design but with versatility to control various AC-APUs.

4.3.11 Digital Simulation of Analog Designs

Any analog regulator circuit that can be built can be simulated by the digital computer, by solving the circuit equations. The only real questions in the current case are: Can the computer solve the equation in real time and if yes, does the computer have enough time to perform the diagnostic
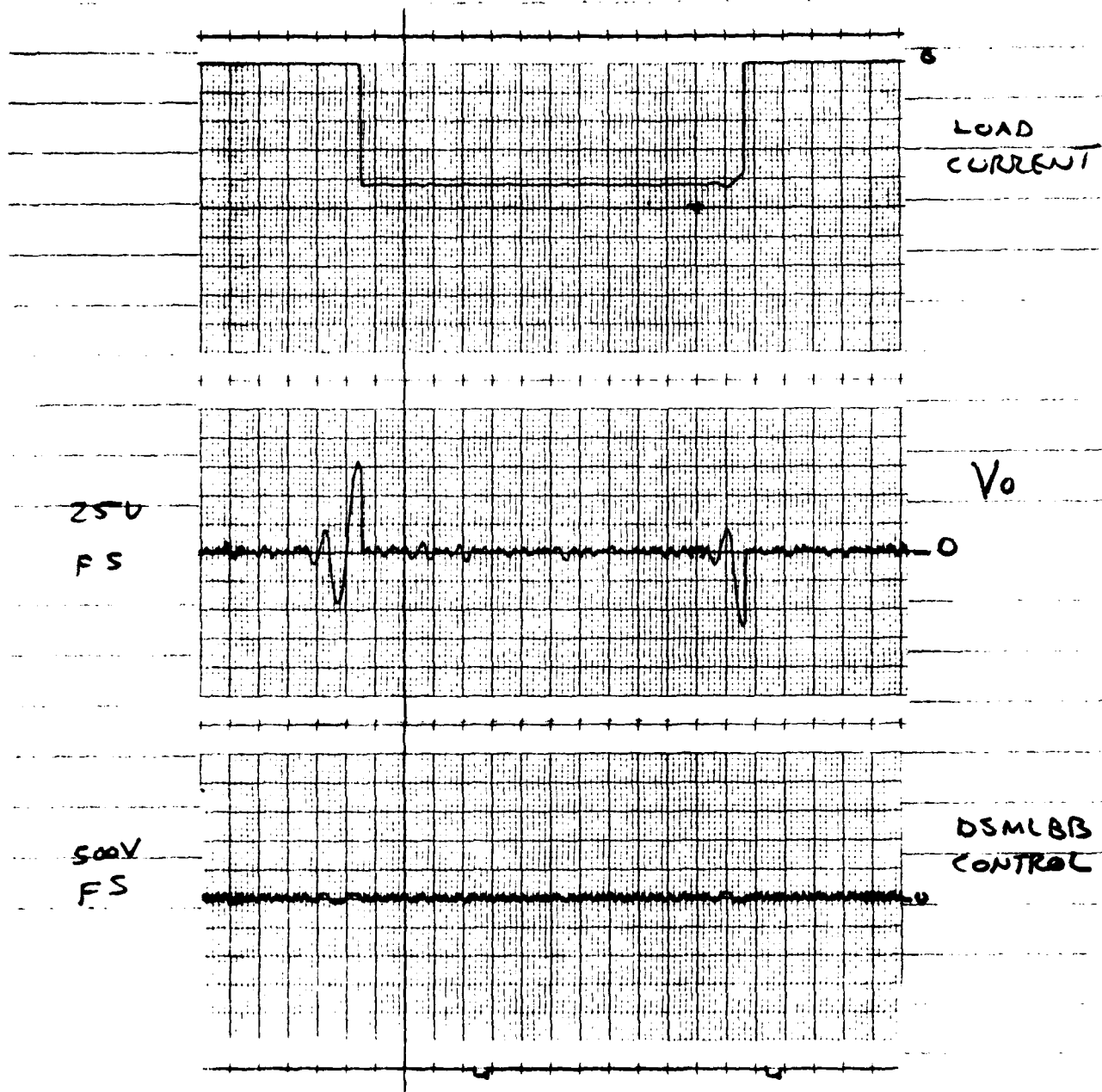
Figure 4-31. An Example of Direction Sensitive
Multi-Level Bang-Bang Control

and monitoring functions? To answer these questions the analog regulator
of Section 4.2 was studied. Based on this circuit, the PACER instruction
times, and solution of the convolution integral at 100 samples, the con-
trolling function could be updated at a rate of approximately 500 Hz and
still maintain the monitor and diagnostic functions.

The additional hardware (over that required for the basic monitoring
and diagnostic system) would be similar to that required for the MLBB cir-
cuit except that approximately 1500 words of additional memory would be
needed. The total additional cost would be about $360.

4.4 HYBRID METHODS

Hybrid regulation is the combination of analog and digital regulation
schemes. This study combined the analog methods described in Section 4.2
with the bang-bang and multiple level bang-bang schemes presented in
Section 4.3.

Under steady state conditions the regulation would be provided by the
analog regulator. However, under *transient conditions, the digital* regula-
tor would provide control. Such a system provides smooth operation, fast
regulation and efficient use of hardware. The smooth operation is provided
through the use of the analog techniques. The fast regulation is provided
through the use of the bang-bang techniques. Because the digital system
is used only on demand in transient situations, the same digital hardware
could conceivably be time shared with the monitor display and diagnostic
functions.

Subroutine D of the flow chart in Figure 4.19b presents the method used
for switching from the digital control to a supplementary parallel controller
such as an analog regulator. When the system is in steady state (output
voltage within a programmed envelope), the supplementary regulator is in
control. When a transient occurs, the digital system is switched into con-
trol.

4.4.1 Analysis of Hybrid Methods

The hybrid techniques are any combination of digital or analog techniques. Ideally, a hybrid technique has the advantages of the individual techniques but none of the disadvantages. Our study has not disproved this; however, we have discovered that hybrid techniques have a particular, although probably minor, problem - that of successfully switching from one technique to another. For example, in one simulation the combination of an analog technique with the bang-bang method would latch in the bang-bang mode. In this particular instance, once the system was placed into bang-bang mode, the analog system was permitted to drift freely; as a result the analog controller was never ready to resume control. This was corrected by forcing the analog regulator to follow the system in the bang-bang mode even though the analog regulator was not actually being used by the system.

4.5 MONITOR AND DIAGNOSTIC SYSTEM

Referring to Figure 4.1, the general microcomputer based controller will consist of: a microcomputer with a variety of digital and analog input/output devices. The analog inputs will include parameters to be monitored (current, frequency, voltage, oil level, etc.) and the diagnostic test points. Analog outputs will include field current control and other system controls. Digital inputs will include inputs from the operators console as well as diagnostic digital inputs. Digital outputs will include commands to the control circuits and control panel (e.g. alphanumeric display and indicator lamps).

4.5.1 Monitor System

The ideal monitoring system as described in Section 1.3 (Design Goals) was studied and a strategy was developed for its implementation.

An operator's display that fits the needs of the monitor design goals is presented as Figure 4-32. It consists of an alphanumeric display and several lighted key switches.

400 HZ	220 VOLTS

VOLTAGE	CURRENT	OIL TEMP.	OIL PRESS.
FREQ.	SPEED	OIL LEVEL	FUEL LEVEL
HARDWARE		COOLANT TEMP.	COOLANT LEVEL

LIGHTED KEY SWITCHES (GREEN AND RED)
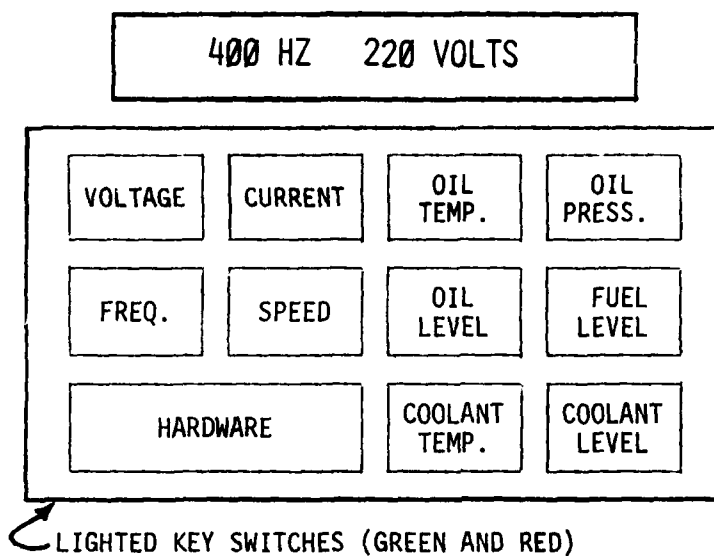
Figure 4-32. Operator's Display

The alphanumeric display is used to present quantitative operating instructions and information. The instructions would guide the operator in the use of the motor generator set and the diagnostic procedures. The quantitative information available for display would include the following:

    Voltage
    Current
    Frequency
    Speed
    Oil Temperature
    Oil Pressure
    Oil Level
    Fuel Level
    Coolant Temperature
    Coolant Level

Under normal conditions, the operator could command the system to display one or more of the parameters on the alphanumeric display. Under fault or near-fault conditions, the display would automatically present the parameters of interest along with any pertinent instructions for the operator (see Section 4.5.2 Diagnostics).

The key switches would have two purposes: To enter operator commands and to present the current status of the various parameters. For example, by pushing the voltage key, the value of the voltage will be presented on the alphanumeric display. If the voltage were within limits the voltage key switch would be green. If the voltage were beyond specified limits, the key switch would blink red. The key switches would also be capable of presenting warnings; for example, if the oil temperature suddenly changed although did not rise beyond the specified limits, the oil temp key switch would turn red. The operator could obtain more information by pressing the key switch. Pertinent information would be presented on the alphanumeric display.

4.5.2 Diagnostics

The exact method of detecting faults must be deferred until the hardware design has been finalized. However, a general strategy has been developed. As described in the design goals, the diagnostics will be of two

types: operating and non-operating.

The operating diagnostics will continuously check the following para-
meters:

Voltage
Current
Frequency
Speed
Oil Temperature
Oil Pressure
Oil Level
Fuel Level
Coolant Temperature
Cooland Level, and
Hardware

These are the same parameters presented on the key switch display.
When the parameters are within specified limits, the diagnostic routine
will set the key switch lamps to green. If any parameters go outside the
specified limits, the key switch will turn red and the appropriate instruc-
tions will be presented to the operator. For example, if the fuel level
is approaching empty, the fuel level lamp will turn red and the alpha-
numeric display may read "ADD FUEL". If any parameter goes beyond the
specifications and into a state in which damage could occur, the key
switch blinks red and the system takes appropriate action to eliminate the
unsafe condition. For example, if the oil temperature were too high the
system would automatically shut down.

These parameters can be combined to form a fault tree to aid in
diagnosing specific faults. For example, by themselves, a rise in oil
temperature and a change in oil level may not be faults; however, the
simultaneous occurrence of the two may indicate an oil leak. This informa-
tion could be passed on to the operator (condition red). If the situation
worsens, the system may automatically shut down (condition blinking red).
The change from red to blinking red may also be a function of time. For
example, if the red condition lasts longer than t time, the condition is
changed to blinking red.

The hardware function will continuously test various key hardware
components. If a fault is detected appropriate action will be taken

automatically (e.g. shut down) and the alphanumeric display will indicate the location of the fault.
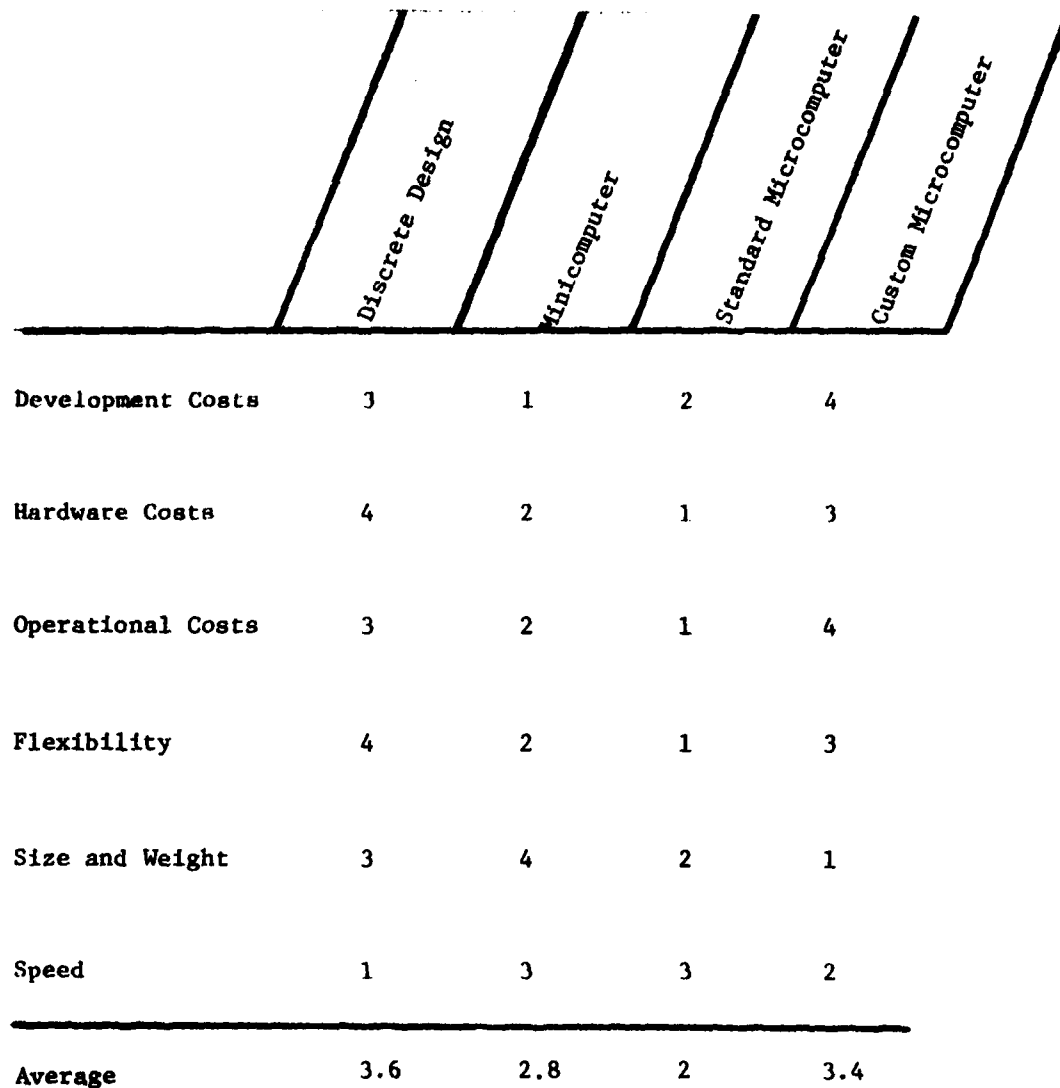
The diagnostics discussed thus far are performed while the system is actually in operation. If possible all the diagnostics should be incorporated into the operating system. However, complete diagnostics may actually require that the system be non-operating. For example, if the system contained digital read/write memory the best test is to write patterns into the memory and to compare what is read with what is written. This cannot easily be performed with the system in operation. Similarly, with analog portions of the system perhaps the system may best be checked by feeding the circuits known inputs which cannot be inserted during normal operation.

4.5.3 Analysis of Monitoring and Diagnostic Methods

The regulation schemes were evaluated based on the assumption that a microcomputer would exist in the controller for the monitoring and diagnostic functions. However, the functions as described in Sections 4.5.1 and 4.5.2 could also be accomplished through the use of discrete analog or digital design; or through the use of a minicomputer. The microcomputer could either be a purchased system (such as the Intel 80/100 single board computer) or a specially designed system based on a standard microprocessor family (such as the Intel 8080 family). The distinction between a minicomputer and a microcomputer is a fine one. The definition used in this study is that a minicomputer is closer to a general purpose computer and is therefore more user-oriented than a microcomputer. An example of a minicomputer is a PDP8. Figure 4.33 is a chart of the relative merits of each method.

The categories compared are: development costs; hardware costs; operational costs; flexibility; size and speed. These are considered as benefit the particular problem of controlling a motor generator.

The development costs for a minicomputer are the lowest, while the cost of the development of a custom microcomputer are the highest. As

81 (A-70 of A-203)

	Discrete Design	Minicomputer	Standard Microcomputer	Custom Microcomputer
Development Costs	3	1	2	4
Hardware Costs	4	2	1	3
Operational Costs	3	2	1	4
Flexibility	4	2	1	3
Size and Weight	3	4	2	1
Speed	1	3	3	2
Average	3.6	2.8	2	3.4

Key: 1 = is best

4 = is worst

Figure 4-33. Evaluation Chart of Diagnostic
and Monitoring Systems.

stated previously, a minicomputer is normally oriented towards the programmer and, therefore, the programming costs are minimized. Also the majority of the hardware design is standard. A commercial microcomputer system is very similar to a minicomputer except that the programming task may be higher because the system is hardware not software oriented.

The lowest hardware cost is expected to be a commercial microcomputer because a minimum system can be assembled from standard parts. The most expensive is expected to be the discrete design because of a greater number of parts and the largest construction costs.

Operational costs include training of operators and maintenance personnel; costs of maintenance and inventory. It is believed that a commercial microcomputer will have the lowest operational costs mainly because the hardware will consist largely of standard, inexpensive circuit boards or modules. The most expensive is expected to be the custom microcomputer. While the components of the custom microcomputer are standard, the basic configuration will be non-standard and, therefore, special maintenance procedures will need to be developed.

The standard microcomputer is believed to have the greatest flexibility in that it can be modified at a minimum cost while a discrete design will be the highest cost. For example, if requirements change for any part of the controller a standard microcomputer may compensate via software, or if software alone will not satisfy the requirement standard components from the microcomputer family can often be used. In a discrete design, however, hardware must always be changed and the changes are rarely minor.

Because a custom microcomputer is designed with the minimum parts, it will most likely be the smallest and lightest system. Analysis of the speed at which the regulator could operate shows that 300 Hz is acceptable if the monitor and display function can also be performed. In this case, all the systems ar· acceptable; however, the discrete design because it will be most likely perform most of the functions in parallel will be the fastest.

83 (A-72 of A-203)

An unweighted average of the values presented in the chart indicates
that the ranking should be as follows (best system first):

> Standard microcomputer
> Minicomputer
> Custom microcomputer
> Discrete design

5. CONCLUSIONS

The following conclusions have been drawn from this study:

1. Simulation of voltage regulation techniques has shown that either analog or digital methods can meet the regulation requirements of MIL-STD-704B. While the only digital method that actually fell within the specification during simulation was the NAVAIR bang-bang technique, the other digital techniques showed the flexibility of a computer based regulator. The simulations lead to the conclusions that the techniques can be optimized to meet the voltage regulation specification.

2. Digital techniques have the advantage over analog techniques. This is mainly due to the minimization of heat generation.

3. The best design method for meeting the diagnostic and monitoring goals is one based on standard microcomputers.

4. A microcomputer can perform all of the control tasks: regulation, diagnostic and monitoring.

6. RECOMMENDATIONS

The following recommendations are suggested as a result of this study:

1. The design of the AC-PAU controller should be based on a microcomputer system.

2. Saturating control should be the general technique of regulation.

3. The next phase of the program should be optimization of regulator design and the hardware implementation of the controller.

DETERMINATION OF CONSTANTS AND
DEVELOPMENT OF TRANSFER CHARACTERISTICS

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TITLE AC-APU

LIST OF SYMBOLS

T_D = DIESEL ENGINE DEVELOPED TORQUE

J_D = DIESEL ENGINE INERTIA

Θ_D = DIESEL ENGINE SHAFT POSITION

K_S = SHAFT SPRING RATE

J_G = GENERATOR INERTIA

Θ_G = GENERATOR SHAFT POSITION

K_T = GENERATOR TORQUE CONSTANT

ϕ = GENERATOR FIELD FLUX

I_λ = LOAD CURRENT

K_D = FRICTION DAMPING ON ROTATING SHAFT

S = LAPLACE TRANSFORM (d/dt)

L_s = STATOR }
R_s = STATOR } SYNCHRINOUS REACTANCE

L_λ = LOAD INDUCTANCE

R_ℓ = LOAD RESISTANCE

K_e = GENERATOR CONSTANT

E_G = GENERATED VOLTAGE

E_ℓ = LINE VOLTAGE

K_f = GENERATOR FIELD GAIN CONSTANT

L_f = " " " INDUCTANCE

R_f = " " " RESISTANCE

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TITLE   AC APU

L_{ex} = EXCITER INDUCTANCE

R_{ex} =   "   RESISTANCE

R_S = SPEED REGULATOR SOLENOID RESISTANCE

L_S =   "   "   "   INDUCTANCE

X_T =   "   "   "   THROTTLE POSITION

K_{Sr} =   "   "   "   RETURN SPRING

J_T =   "   "   "   INERTIA

K_D =   "   "   "   DAMPING

K_1 = GAIN TRANSFER OF T_D/X_T

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DEVELOPMENT OF EQUATIONS

1) $T = \left(J_D s^2 + K_D s\right)\Theta_D = \left(\Theta_D - \Theta_G\right)K_s = \left(J_G s^2 + K_T I \phi s\right)\Theta_G$

$$K_s \Theta_D = \left(J_G s^2 + K_T I \phi s\right)\Theta_G + K_s \Theta_G$$

2) $\Theta_D = \left[\left(\dfrac{J_G}{K_s} s^2 + \dfrac{K_T I \phi}{K_s} s\right) + 1\right]\Theta_G$

SUBSTITUTING IN 1)

3) $T = \left(J_D s^2 + K_D s\right)\left[\left(\dfrac{J_G}{K_s} s^2 + \dfrac{K_T I \phi}{K_s} s\right) + 1\right]\Theta_G$

4) $\dfrac{s\Theta_G}{T} = \dfrac{1}{K_D\left(\dfrac{J_D}{K_D} s + 1\right)\left[\dfrac{J_G}{K_s} s^2 + \dfrac{K_T I \phi}{K_s} s + 1\right]}$

SINCE I & ϕ WILL BE VARIABLES

WE MUST BRING THESE OUT.

5) $T - J_G s^2 \Theta_G = K_T I \phi s \Theta_G$

THIS IS BASIC AND DOES NOT INCLUDE DRIVE CHARACTERISTICS.

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THIS CAN BE IN A FEEDBACK FORM
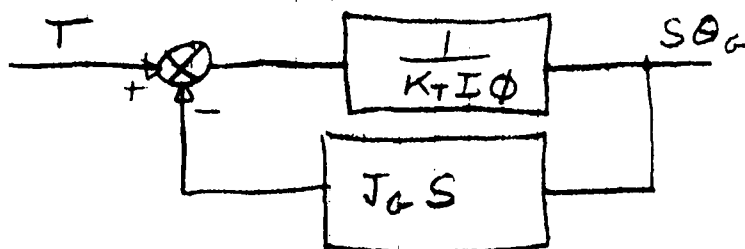
CHECKING THE LOOP WE HAVE

6) $$\frac{S\Theta_G}{T} = \frac{\frac{1}{K_T I \phi}}{1 + \frac{1}{K_T I \phi}(J_G S)} = \frac{1}{K_T I \phi + J_G S}$$

7) $$\frac{S\Theta_G}{T} = \frac{1}{K_T I \phi \left(\frac{J_G}{K_T I \phi} S + 1\right)}$$

EXPANDING WE FIND

$$T = J_G S^2 \Theta_G + K_T I \phi S \Theta_G$$

THIS CHECKS WITH 5)

HE DIURNAL CHARACTERISTICS MUST
BE INCLUDED.
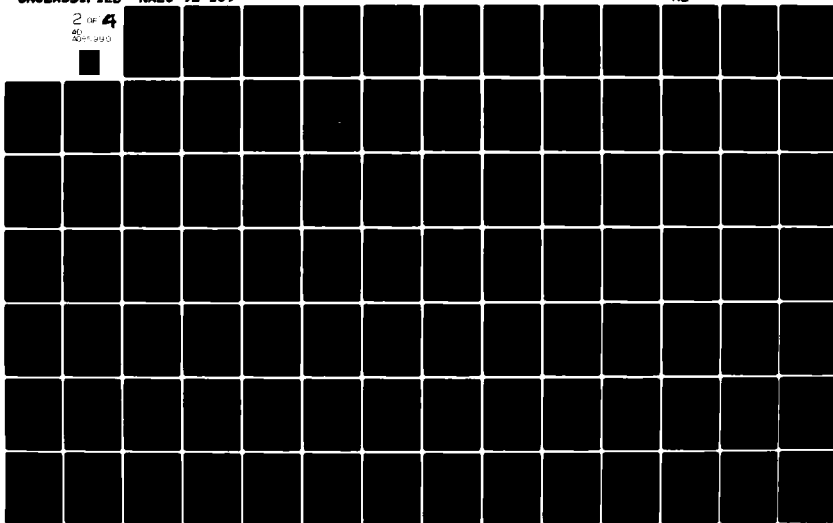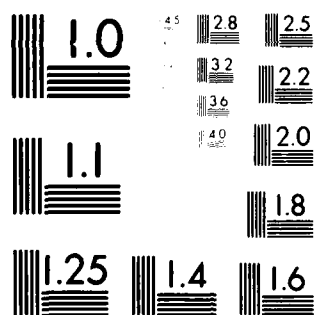
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8) FROM 1)

$$T = \left(J_D s^2 + K_D s\right)\Theta_D = \left(\Theta_D - \Theta_G\right)K_S$$

$$J_D s^2 \Theta_D + K_D s \Theta_D = K_S \Theta_D - K_S \Theta_G$$

EXPANDING 3)

9) $$\frac{T}{\Theta_G} = \frac{J_D J_G}{K_S}s^4 + \frac{J_D K_T I\phi}{K_S}s^3 + J_D s^2 + \frac{J_G K_D}{K_S}s^3 + \frac{K_D K_T I\phi}{K_S}s^2 + K_D s$$

$$\frac{T}{s\Theta_G} = \frac{J_D J_G}{K_S}s^3 + \frac{J_G K_D}{K_S}s^2 + J_D s + K_D + K_T I\phi s\left[\frac{J_D}{K_S}s + \frac{K_D}{K_S}\right]$$

10) $$\frac{T}{s\Theta_G} = K_D\left[\frac{J_D J_G}{K_D K_S}s^3 + \frac{J_G}{K_S}s^2 + \frac{J_D}{K_D}s + 1\right] + \frac{K_D K_T I\phi}{K_S}s\left[\frac{J_D}{K_D}s + 1\right]$$

11) $$T - K_D\left[\frac{J_D J_G}{K_D K_S}s^3 + \frac{J_G}{K_S}s^2 + \frac{J_D}{K_D}s + 1\right]s\Theta_G = \frac{K_D K_T}{K_S}(I\phi)s\left[\frac{J_D}{K_D}s + 1\right]s\Theta_G$$

IN FEEDBACK FORM THIS IS:—

$$T \xrightarrow{+} \bigotimes \xrightarrow{-} \boxed{\dfrac{K_S}{(I\phi)\,K_T\,S\,(J_D S + K_D)}} \longrightarrow S\theta_G$$

$$K_D\left[\frac{J_D J_G}{K_D K_S}S^3 + \frac{J_G}{K_S}S^2 + \frac{J_D}{K_D}S + 1\right]$$
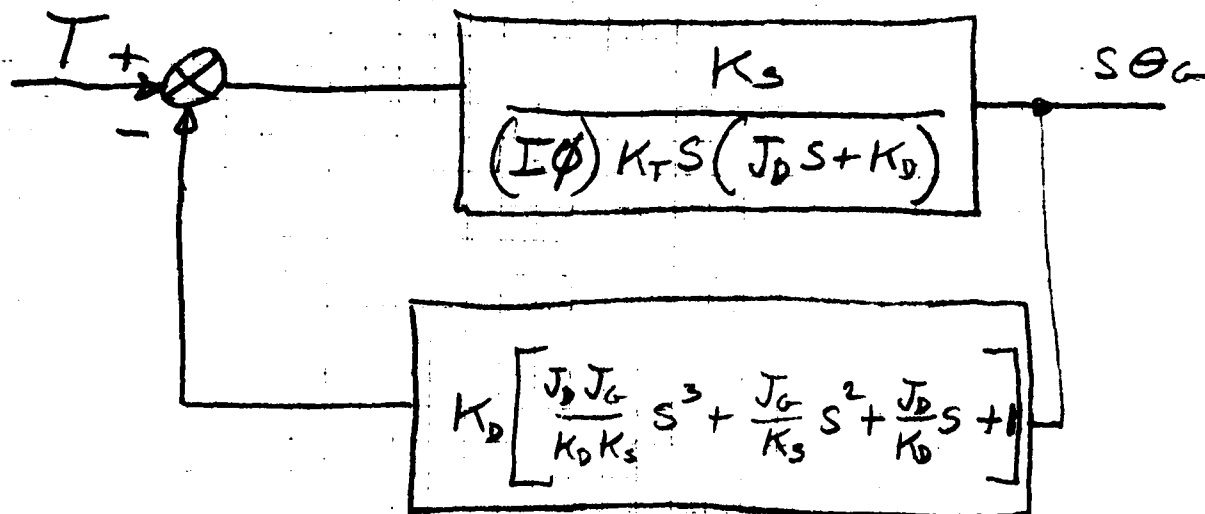
CHECKING THE LOOP WE HAVE:-

12)
$$\frac{S\theta_G}{T} = \cfrac{\cfrac{K_S}{S(K_T I\phi)(J_D S + K_D)}}{1 + \cfrac{K_S}{S(K_T I\phi)(J_D S + K_D)}\left(\frac{J_D J_G}{K_S}S^2 + \frac{J_G K_D}{K_S}S^2 + J_D S + K_D\right)}$$

13)
$$\frac{S\theta_G}{T} = \frac{K_S}{S K_T I\phi (J_D S + K_D) + \left[J_D J_G S^3 + J_G K_D S^2 + K_S J_D S + K_D K_S\right]}$$

14)
$$\frac{S\theta_G}{T} = \frac{1}{\left[\frac{J_D J_G}{K_S}S^3 + \left(\frac{J_D K_T I\phi + J_a K_D}{K_S}\right)S^2 + \left(\frac{K_T I\phi K_D}{K_S} + J_D\right)S + K_D\right]}$$

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THIS REDUCES TO

15) $\dfrac{T}{S\theta_G} = \dfrac{J_D J_G}{K_S}S^3 + \dfrac{J_G K_D}{K_S}S^2 + J_D S + \dfrac{J_D}{K_S}K_T I\phi S^2 + \dfrac{K_D K_T I\phi}{K_S}S + K_D$

16) $\dfrac{T}{S\theta_G} = K_D\left[\dfrac{J_D J_G}{K_D K_S}S^3 + \dfrac{J_G}{K_S}S^2 + \dfrac{J_D}{K_D}S + 1\right] + K_T I\phi\left[\dfrac{J_D}{K_S}S^2 + \dfrac{K_D}{K_S}S\right]$

THIS CHECKS WITH 10)

17) THE TRANSFER CHARACTERISTIC OF THE ALTERNATOR FIELD IS

$$E_f \quad \boxed{\dfrac{K_f}{T_f S + 1}} \quad \phi$$
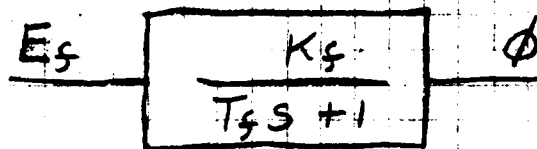
$$T_f = \dfrac{L_f}{R_f}$$

18) THE TRANSFER CHARACTERISTIC OF THE EXCITER IS
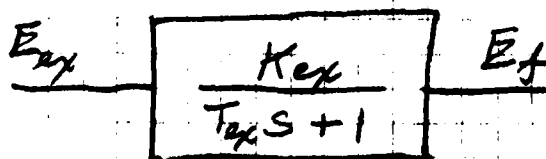
$$E_{ex} \quad \boxed{\dfrac{K_{ex}}{T_{ex} S + 1}} \quad E_f$$

$$T_{ex} = \dfrac{L_{ex}}{R_{ex}}$$

19) THE ALTERNATOR INHERENT REGULATION IS EXPRESSED AS:-

$$E_\ell = E_G + I_\ell R_s$$

20) $$I_\ell = \frac{E_\ell}{R_\ell}$$

21) $$\frac{E_\ell}{E_G} = \frac{R_\ell}{R_\ell + R_s}$$

22) $$\frac{I_\ell}{E_G} = \frac{1}{R_s\left(\frac{L}{R_s}S + 1\right)}$$

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TITLE DETERMINATION OF CONSTANTS FOR AC-APU

1860 LB IN. T_{D_1} = DIESEL ENGINE DEVELOPED TORQUE

930 LB IN. T_{D_4} = DIESEL ENGINE TORQUE DUE TO COMPRESSION

12.763 LB·IN·SEC^2 J_D = DIESEL ENGINE INERTIA

     Θ_D = DIESEL ENGINE SHAFT POSITION

62.14×10^6 LB·IN/RAD K_S = SHAFT SPRING RATE

12.37 LB·IN·SEC^2 J_G = GENERATOR INERTIA

     Θ_G = GENERATOR SHAFT POSITION

1.572×10^3 LB·IN/A/LINE K_T = GENERATOR TORQUE CONSTANT

10.95×10^3 LINES/IN^2 ϕ = GENERATOR FIELD FLUX

83.27 A I_f = FULL LOAD CURRENT

.1369 LB·IN·SEC K_D = FRICTION DAMPING ON ROTATING SHAFT

     S = LAPLACE TRANSFORM (d/dt)

$\left.\begin{array}{l} L_s \\ R_s \end{array}\right\}$ EFFECTIVE GENERATOR IMPEDANCE

$\left.\begin{array}{l} L_l = \\ R_l = \end{array}\right\}$ LOAD IMPEDANCE

.091×10^{-3} V/radian/line·in^2 K_e = GENERATOR CONSTANT

208V E_G = GENERATED VOLTAGE

     E_l = LOAD VOLTAGE

385.84 line·in^2/volt K_f = GENERATOR FIELD GAIN CONSTANT

.2295 H L_f = GENERATOR FIELD INDUCTANCE

1.72 Ω R_f = GENERATOR FIELD RESISTANCE

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$.46 H$ $L_{ex} = $ EXCITER   INDUCTANCE

$2.4 \, \Omega$ $R_{ex} = $ "   RESISTANCE

$3.46 V/V$ $K_{ex} = $ "   VOLTAGE GAIN

1) DIESEL ENGINE

HERCULES D-298-ER (76 HP)
RATED FOR 219 LB-FT @ 2000 rpm.
BSFC = .392 LB/BHP HR
#/HR = .392 × 83.5 = 32.73 LB/HR

THE ENGINE LOAD IS DETERMINED BY —

30 KW   1.00 P.F.   88.5% EFF

SHAFT LOAD $\frac{30}{1 \times .885} = 33.9 \, KW$, $\frac{33.9}{.746} = 45.44 \, HP$

$T_G = \frac{45.44 \times 550 \, FTLB/SEC}{209.3 \, RAD/SEC} = 119.41 \, LB \, FT.$

F&W LOSSES [PAGE G-03, (183)] = 576.1 W
TOTAL LOSSES [PAGE G-03, (247)] = 3871 W

% F&W LOSSES $\frac{576.1 \times 100}{30000} = 1.99\% = 2.376 \, LB \, FT.$

FOR THE INITIAL RUNS THE TORQUE
LIMIT WAS SET FOR 130% OF 119.41
OR 155 LB FT × 1860 LB.IN.

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THE DECELERATION TORQUE IS DEVELOPED
FROM THE KNOWN COMPRESSION RATIO OF
THE ENGINE.

FOR THE <u>WHITE</u> ENGINE #DX-1678

COMPRESSION RATIO = 17.5:1

AIR INTAKE = 14.5 PSI

INCREASE IS $(17.5)(14.5) - 14.5 = 239.5$ PSI

STROKE = 4.5" $Y = 2.25"$

BORE = 3.75" $A = \frac{\pi D^2}{4} = .785(14.05) = 11.03$ in²

T_D @ 2000 rpm = 154 × 12 = 1850 LB IN.

$h_o = 4.78"$

$$\frac{P_c}{P} = \frac{h_o - Y(1 - \cos\theta)}{h_o}$$
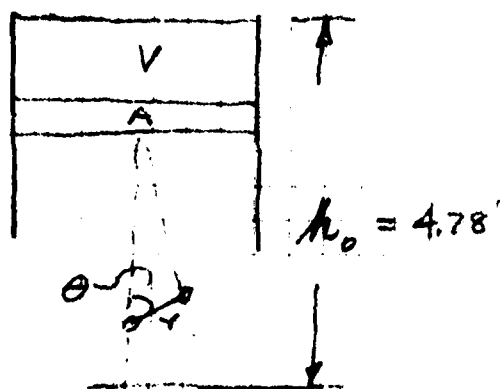
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				C4258-06	
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$$T_{D_2} = F r \sin \theta$$

$$F = \left[\frac{P_1}{P_0} (14.7) - 14.7 \right] A$$

$$F = 162 \left[\frac{P_1}{P_0} - 1 \right]$$

$$\therefore \quad T_{D_2} = 364.5 \left[\frac{P_1}{P_0} - 1 \right] \sin \theta$$

θ	$\frac{P_1}{P_0}$	F	T_D
$0°$	1.0	0	0
$30°$	1.068	11	12.4 LBIN
$60°$	1.308	49.9	97.3
$90°$	1.99	160	360
$120°$	3.3	372	725
$150°$	8.25	1338	1505
$180°$	17.1	2610	0

USING AN AVERAGE VALUE WE
HAVE   .636 × 1305 = 757 LB IN

FOR SIMULATION USE A RATIO OF 2:1
FOR DEVELOPED TORQUE TO COMPRESSION TORQUE

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DIESEL ENGINE INERTIA (J_D)

HERCULES MODEL D-298-ER

MASSES :-

   .036 + .235 + .143 + .21 + .21 + .143 + .236 + 11.76

   TOTAL = 12.763 LB. IN. SEC²

SHAFT SPRING RATE (K_S)

   $K_S = 82.94 \times 10^6$ LB IN/RAD.

GENERATOR INERTIA (J_G)

   30 KW 400 HZ

MASSES :-

   12.03 + .34

   TOTAL = 12.37 LB. IN SEC²

2.) GENERATOR TORQUE CONSTANT (K_T)

   $$K_T = \frac{T_G}{I_1 \emptyset} = \frac{119.41}{83.27 (10.95 \times 10^3)} = .131 \times 10^{-3} \frac{LB\text{-}IN}{A/F\omega}$$

   $$K_T = 1.572 \times 10^{-3} \text{ LB IN}/A/LINE \text{ OF } FLUX$$

3) FRICTION DAMPING ON ROTATING SHAFT

F+W LOSSES (SEE PAGE 2)

F+W = 2.376 LB FT.

$$K_D = \frac{2.376 \; LB \; FT}{209.3 \; RAD/SEC} = .0114 \; \frac{LB \; FT \; SEC}{RAD}$$

$$K_D = .1369 \; \frac{LB \; IN \; SEC}{RAD}$$

4) GENERATOR CONSTANT (K_e)

$E_G = 208$ VOLTS

$S\Theta_G = 2000 \frac{rev}{min} \times \frac{min}{60 \; sec} \times \frac{2\pi \; rad}{rev} = 209.3 \; rad/sec$

$$K_e = \frac{E_G}{S\Theta_G \; \phi} = \frac{208}{(209.3)(10.95 \times 10^3)}$$

$$K_e = .091 \times 10^{-3} \; V/rad/sec/lines/in^2$$

5) GENERATOR FIELD CONSTANT: (K_f)

$$K_f = \frac{\phi}{E_f}$$

FROM FIELD SATURATION CURVE

$E_a = 416V$

$I_F = 16.5A$

$R_F = 1.72\ \Omega$

$E_f = 16.5 \times 1.72 = 28.38\ V$

$\therefore\ K_f = \dfrac{10.95 \times 10^3}{28.38} = 385.84\ lines/in^2/volt$

GENERATOR SATURATION
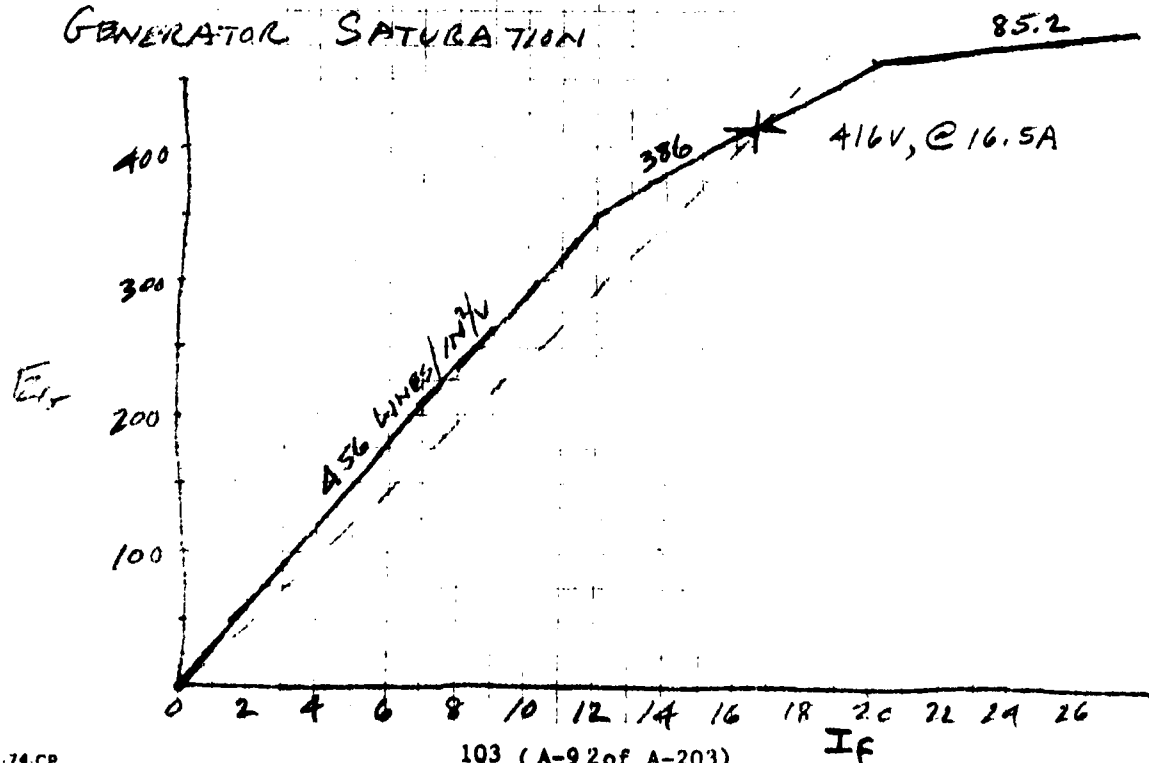
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J. STONE	6/7/72			
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			C4258-06	
TITLE				

SIMULATION OF SATURATION BY
2 BREAKS, (FROM GEN. CURVE 37.5KVA 400HZ)

1ST SLOPE

$$\frac{478}{405} \times 386 = \underline{456} \text{ LINES}/\text{IN}^2/\text{V}$$

BREAK @ 330V

$$\phi = \frac{330}{416} \times 10.95 \times 10^3 = 8.7 \times 10^3 \text{ LINES}/\text{IN}^2$$

2nd SLOPE

$$\left(\text{FOR 386 LINES}/\text{IN}^2/\text{V} : = \frac{197}{8 \times 1.72} = 14.32 \text{ V}/\text{V} \right)$$

$$\frac{122}{8 \times 1.72} = 8.86 \text{ V}/\text{V}$$

$$\frac{8.86}{14.32} \times 386 = \underline{239} \text{ LINES}/\text{IN}^2/\text{V}$$

BREAK @ 455V

$$\phi = \frac{455}{416} \times 10.95 \times 10^3 = 12 \times 10^3 \text{ LINES}/\text{IN}^2$$

3rd SLOPE

$$\frac{67}{16 \times 1.72} = 3.16 \text{ V}/\text{V}$$

$$\frac{3.16}{14.32} \times 386 = \underline{85.2} \text{ LINES}/\text{IN}^2/\text{V}$$

6) GOVERNOR FOR DIESEL ENGINE

ELECTRICAL INPUT TO GOVERNOR
WILL CAUSE THROTTLE VALVE
TO MOVE A DESIRED AMOUNT.
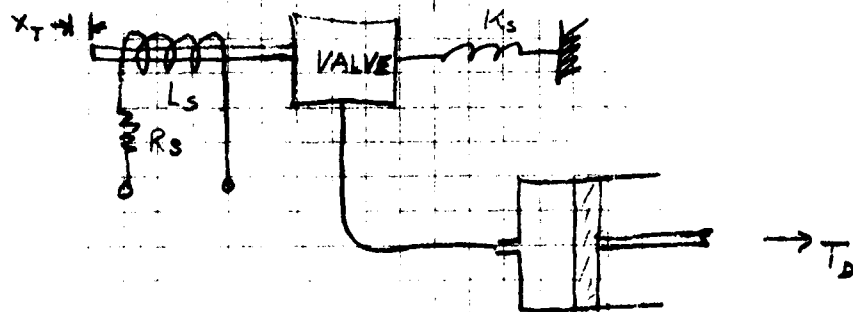
TRANSFER CHAR. OF SOLENOID

$$F_s = NI = J s^2 x_T + K_D x_T + K_s x_T$$

$$E = I (R_s + s L_s)$$

$$\frac{I}{E} = \frac{1}{R_s \left(\frac{L_s}{R_s} s + 1 \right)}$$

$$\frac{NI}{E} = \frac{N}{R_s \left(\frac{L_s}{R_s} s + 1 \right)} = \frac{F_s}{E}$$

$$\therefore \quad \frac{x_T}{NI} = \frac{1}{K_s \left(\frac{J}{K_s} s^2 + \frac{K_D}{K_s} s + 1 \right)}$$

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ENGINE TORQUE

$$T_D = PA$$

$$Q = A(SX_P) \qquad \frac{Q}{A} = SX_P$$

$$SX_P = KS\theta_D \qquad A = \frac{Q}{KS\theta_D}$$

$$\therefore T_D = P\left(\frac{Q}{KS\theta_D}\right)$$

FROM INFORMATION ON WHITE DIESEL ENGINE MODEL D-2300 WE FIND A RELATION OF TORQUE VS LBS. OF FUEL/HR AT SPECIFIC SHAFT SPEEDS. FOR OUR SIMULATION WE WILL USE A CONSTANT. THE ACTUAL RELATION IS:-

SINCE $Q = K_T X_T$

$$T_D = \frac{P}{K}\left(\frac{K_T X_T}{S\theta_D}\right)$$

$$\frac{T_D}{X_T} = \frac{K'}{S\theta_D}$$

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FROM LUCAS (MARCH 10,1976)
ARTICLE OF GOVERNING OF OIL
ENGINES PAGE 23, THE CONTROL
ROD OPENING VARIES FROM
2 - 8 mm.

FOR FULL OPEN THROTTLE WE
WILL USE

$$X_T = \frac{.8 cm}{2.54 cm} \text{ in} \doteq .315 \text{ IN.}$$

THE ENGINE CONSTANT (K_1)
WILL BE EXPRESSED AS.

$$K_1 = \frac{T_D}{X_T} = \frac{119.41}{.315} \left(\frac{12 \text{ IN}}{FT} \right)$$

$$K_1 = 4550 \frac{LB.IN.}{IN.}$$

ASSUME A COIL POWER LEVEL · 30W

$$I = \frac{30 W}{28 V} = 1.07 A$$

$$R_S = \frac{28}{1.07} = 26.13 \Omega$$

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TITLE				

ALSO ASSUME A TIME CONSTANT
OF $T = .015$

$$T = \frac{L_s}{R_s} = .015 = \frac{L_s}{26.13}$$

$$L_s = .392 \ H$$

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TITLE			

SIMULATION OF ALTERNATOR FIELD SATURATION
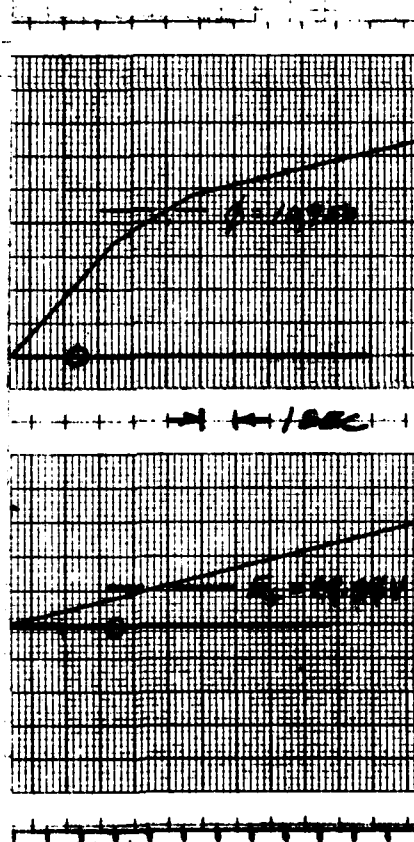
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				C4258-06	
TITLE					

EFFECT OF TORQUE LIMIT
ON SIMULATION OF
DIESEL ENGINE
START UP AND SHUT DOWN

T_D
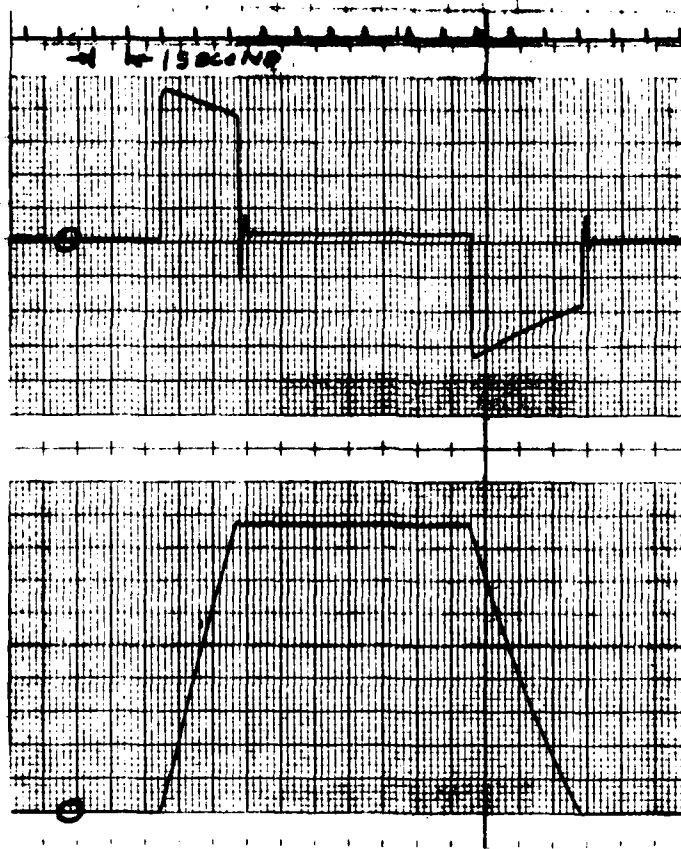
$\dfrac{S\theta_G}{100}$

COMPUTERIZED LITERATURE SEARCHES
ON THE SUBJECT OF REGULATION DESIGN

User 244   Date:03/25/76   Time:06:00:44   File: 8

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Set Items Description
  1    878 ELECTRIC MACHINERY
  2    560 ELECTRIC GENERATORS
  3     11 ELECTRIC MOTOR GENERATOR SETS
  4   1417 1-3/OR
  5   2932 CONTROL SYSTEMS
  6      0 BANG BANG
  7  15083 DIGITAL
  8    419 PREDICTIVE
  9   3416 PROPORTIONAL
 10      0 SAMPLED DATA
 11  18699 7-10/OR
 12      1 4 AND 5 AND 11
 13      8 4 AND 5
 14     21 COMPUTER SYSTEMS
 15      0 4 AND 14
 16    741 COMPUTER SYSTEMS, DIGITAL
 17      0 4  AND 16
```

Print 13/5/1-8

Search Time: 15.42   Prts.:   8   Descs.:   9

ID NO.- EI750850836   550836
SELECTION OF OPTIMAL PARAMETERS FOR AN AUTOMATIC GENERATION CONTROL SYSTEM.
Ramamoorty, M.; Kibe, A. V.
Indian Inst of Technol, Kanpur
DESCRIPTORS- *CONTROL SYSTEMS, ELECTRIC GENERATORS, (MATHEMATICAL TECHNIQUES, Linearization),
CARD ALERT- 731, 705, 921
CODEN- JEELAC   SOURCE- J Inst Eng (India) Electr Eng Div v 55 pt EL 3 Feb 1975 p 129-133
The system provides proper input signals to each area controller to minimize the deviations in frequency and tie line power due to any sudden disturbance in the system by loss of generation or load variation. Concept of minimum settling time to obtain optimum gains for the controller inputs is used. The system sensitivity for different parameters is also investigated. 4 refs.

ID NO.- EI750637327   537327
THYRISTOR PULSE-FREQUENCY CONTROL SYSTEMS FOR ELECTRICAL MACHINES.
Lifanov, S. V.; Morgovskiy, Yu. Ya.
DESCRIPTORS- (*ELECTRIC MACHINERY, *Control Systems), PULSE TIME MODULATION,
CARD ALERT- 705, 716, 731
CODEN- SAUCBZ   SOURCE- Sov Autom Control v 7 n 5 Sep-Oct 1974 p 62-66
Discussed are pulse-frequency control systems for electrical machines, using thyristor pulse shapers, intended for speed regulation of dc motors and control of synchronous generator voltages. It is shown that by using pulse-frequency modulation instead of pulsewidth modulation, it is possible to reduce the commutation losses and simplify the instrumentation. The problem of determining the parameters of a modulator that minimizes the commutation losses is examined. 8 refs.

ID NO.- EI750208798   508798
OB USTROICHIVOSTI KOMBINIROVANNYKH SISTEM AVTOMATICHESKOGO REGULIROVANIYA ELEKTRICHESKIKH MASHIN. $left bracket$ Stability of Combined Control Systems of Electric Machines $right bracket$.
Lekakh, M. N.
DESCRIPTORS- (*ELECTRIC MACHINERY, *Control Systems), (CONTROL SYSTEMS, Invariance), SYSTEM STABILITY,
CARD ALERT- 705, 731
CODEN- ELKTAQ   SOURCE- Elektrotekhnika n 11 Nov 1974 p 39-43
It is shown that automatic control by dependent disturbances in the class of systems designed in accordance with the combined principle of control results in a change in the characteristic equation and, consequently, in the dynamic properties of the system. In Russian.

ID NO.- EI741169341   469341
USTROISTVO DLYA KONTROLYA SOSTOYANIYA SISTEMY NEPOSREDSTVENNOGO
VODYANOGO OKHLAZHDENIYA OBMOTKI STATORA SINKHRONNYKH GENERATOROV.
$left bracket$ Device for Controlling the State of the System of
Direct Cooling by Water of the Synchronous Generator Stator Winding
$right bracket$.
  Vainshtein, R. A.; Getmanov, V. T.; Chikunov, A. G.
  Tomsk Polytech Inst im. S. M. Kirov, USSR
  DESCRIPTORS- (*ELECTRIC GENERATORS, *Protection), (ELECTRIC
MACHINERY, Cooling), CONTROL SYSTEMS,
  CARD ALERT- 701, 705, 731
  CODEN- IVZEAY SOURCE- Izv Vyssh Uchebn Zaved, Energ n 7 Jul 1974
p 9-12
  The necessity for and the usefulness of technical development of
devices permitting control of the state of the system of cooling of
stator windings of synchronus generators, with direct cooling by
water, is demonstrated. Problems of development of a device of this
kind utilizing electric values with the frequency of 25 Hz are set
forth. This device is to be introduced into the primary circuit of
the generator to implement failure-proof protection against
short-circuiting to the ground. In Russian.

ID NO.- EI741061916   461916
O KLASSIFIKATSII ELEKTRICHESKIKH MASHIN DLYA SISTEM AVTOMATICHESKOGO
UPRAVLENIYA. $left bracket$ Classification of Electric Machines for
Automatic Control Systems $right bracket$.
  Batovrin, A. A.; Titov, N. P.
  DESCRIPTORS- (*ELECTRIC MACHINERY, *Control), CONTROL SYSTEMS, (
INFORMATION SCIENCE, Classification),
  CARD ALERT- 705, 731, 901
  CODEN- IVUEA9 SOURCE- Izv Vyssh Uchebn Zaved, Elektromekh n 5 May
1974 p 539-546
  Problems of classification of electric machines working in automatic
control systems are considered. Division of all machines into power
and information machines is proposed. A classification table is given
of the main elements of automatic control systems with their transfer
and transition functions. Each element is exemplified in the table by
one or more types of electric machines. In Russian.

ID NO.- EI740313337   413337
   DAS   DONAUKRAFTWERK   OTTENSCHEIM-WILHERING. $left bracket$
Ottensheim-Wilhering Hydroelectric Power Plant on the Danube $right
bracket$.
   Anon
   DESCRIPTORS- (*HYDROELECTRIC POWER PLANTS, *Austria), (HYDRAULIC
TURBINES, Tubular), (ELECTRIC GENERATORS, Hydroelectric), (RIVER BASIN
PROJECTS, Austria), CONTROL SYSTEMS, ELECTRIC POWER SYSTEMS,
   CARD ALERT- 402, 441, 611, 632, 706, 731
   CODEN- OBZOBC   SOURCE- OZE Oesterr Z Elektr   v 26 n 10 Oct 1973 p
397-542
   The entire issue of the journal is devoted to the new hydroelectric
power plant on the Danube in Austria which is to be put into service
at the end of 1973. This is the fourth multipurpose project built in
Austria, utilizing water resources of the Danube. The total of 25
articles is divided into 6 sections. The first section contains a
general article about the turbine types at Austrian hydroelectric
power plants and on special problems of the new Kaplan tubular
turbine, and an article comparing the present project with its
immediate predecessor. The second section (10 articles) deals with
general planning and construction work with a detailed article on the
project, on the tubular turbine, etc. The third section (7 articles)
dealing with mechanical engineering and electrical engineering work
describes the turbine unit, turbine controllers, power generation
equipment, high voltage equipment, control equipment, etc. The fourth
part (2 articles) describes the hydraulic steel structures, such as
locks. The fifth part (3 articles) deals with maintenance and
management problems. The last part contains the most important
factual data about the plant and its construction. In German.

ID NO.- EI740312291   412291
   ISSLEDOVANIE TSIFROVOI SISTEMY AVTOMATICHESKOGO REGULIROVANIYA
NAPRYAZHENIYA GENERATORA. $left bracket$ Investigation of a Digital
System of Automatic Control of Generator Voltage $right bracket$.
   Serkov, V. I.; Solov'ev, V. N.
   DESCRIPTORS- (*ELECTRIC GENERATORS, *Control Systems), (CONTROL,
ELECTRIC VARIABLES, Voltage), CONTROL SYSTEMS, DIGITAL,
   CARD ALERT- 731, 706, 715, 705, 701
   CODEN- IVUEA9   SOURCE- Izv Vyssh Uchebn Zaved, Elektromekh n 9 Sep
1973 p 966-970
   A digital controller is proposed for maintaining generator voltage.
On the basis of a proposed diagram of stability and quality,
constructed in the space of the coefficients of the characteristic
equation of a closed system, parameters are selected for the algorithm
of a digital computer. Recommendations are given for meeting various
technical requirements with respect to the control system of generator
voltage. In Russian.

ID NO.- EI730101275   301275
POWER SYSTEM GENERATOR STABILITY USING STATE SPACE TECHNIQUES.
Webb, A. J.; Sheard, G.
The Electricity Commission of New South Wales, Sydney
DESCRIPTORS- (*ELECTRIC GENERATORS, *Control), CONTROL SYSTEMS,
CARD ALERT- 705, 731
CODEN- PRAUA6   SOURCE- Proc Inst Radio Electron Eng, Australia v 33
n 5 May 1972 p 182-186

The stable operation of the generators in a large electric power
system can be substantially improved by using supplementary signals in
addition to terminal voltage as feedback information to the
generators' automatic excitation regulators. The selection and
conditioning of available signals has been investigated by applying
linear state space techniques to the generators and their excitation
systems and stability and damping assessed by examination of the
eigenvalues of the state matrix. 14 refs.

User 244   Date:03/25/76   Time:06:35:09   File:13

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Set Items Description
  1      3 ELECTRIC MACHINERY
  2    213 ELECTRIC GENERATORS
  3      0 ELECTRIC MOTOR GENERATOR SETS
  4    216 1-3/OR
  5   2112 CONTROL SYSTEMS
  6      7 BANG BANG
  7  21600 DIGITAL
  8    235 PREDICTIVE
  9    932 PROPORTIONAL
 10     26 SAMPLED DATA
 11  22690 6-10/OR
 12      0 4 AND 5 AND 11
 13      2 4 AND 5
 14      1 4 AND 11
 15    261 COMPUTER SYSTEMS
 16      0 4 AND 15
 17      0 VOLTAVGE
 18   6396 SPEED
 19     38 RPM
 20   6423 17-19/OR
 21  12633 VOLTAGE
 22  18714 20 OR 21
 23   1263 REGULATOR
 24    125 GOVERNOR
 25  54765 CONTROL
 26  55173 23-25/OR
 27    857 ENGINE
 28   4807 GENERATOR
 29     19 ROTATING MACHINERY
 30     39 ALTERNATING CURRENT
 31   5679 27-30/OR
 32   8881 SWITCHING
 33      1 PROPORTIONAL BAND
 34   8882 32 OR 33
 35   9810 6 OR 9 OR 34
 36    286  22 AND 26 AND 31
 37     14 35 AND 36
 38     36 22 AND 31 AND 35
 39  41580 COMPUTER
 40  21600 DIGITAL
 41    238 MICROPROCESSOR
 42      0 MICRO PROCESSOR
 43   1150 MINICOMPUTER
 44      1 MICRO(W)PROCESSOR
 45   6658 39-44/OR
 46    869 2 AND 45
 47   3467 34 AND 45 AND 35
 48     28 31 AND 45 AND 35
 49    975 27 OR 29 OR 30
 50      6 49 AND 005
```

859736   C7604562
AN APPLICATION IN ENGINE TESTING
  LOWRES,   E.J.   ; GEC-ELLIOTT PROCESS AUTOMATION, BOREHAMWOOD,
ENGLAND
  MINICOMPUTER FORUM   585-600   1975
  11-13 FEB. 1975   LONDON, ENGLAND
  PUBL: ONLINE   UXBRIDGE, MIDDX., ENGLAND
  DESCRIPTORS: ENGINEERING   APPLICATIONS   OF COMPUTERS, INTERNAL
COMBUSTION ENGINES
  IDENTIFIERS: ENGINE TESTING, AUTOMATION EQUIPMENT, MINICOMPUTER,
SOFTWARE PACKAGE CONRAD, INTERNAL COMBUSTION ENGINE TESTING, QUALITY
CONTROL
  SECTION CLASS CODES: C8847
  UNIFIED CLASS CODES: WMEMAD
  THE TESTING OF INTERNAL COMBUSTION ENGINES IN MANY WAYS LENDS ITSELF
TO AUTOMATION BUT IT HAS BEEN FOUND THAT STANDARD MINI COMPUTER
:AUTOMATION: PACKAGES FALL SHORT IN THIS APPLICATION. THE PAPER
DESCRIBES THE BASIC REQUIREMENTS OF THE AUTOMATION EQUIPMENT AND
ILLUSTRATES THESE BY GIVING AN EXAMPLE OF A TYPICAL TEST PERFORMED ON
AN ENGINE. THE APPLICATION OF A MINICOMPUTER TO PERFORM THESE
FUNDAMENTAL REQUIREMENTS HAS LED TO THE DEVELOPMENT OF A SOFTWARE
PACKAGE CONRAD. IT IS SHOWN HOW CONRAD MEETS THE PRIME REQUIREMENTS,
PROVIDING THE ENGINEER WITH A FACILITY BY WHICH HE CAN MAKE BASIC
CHANGES TO THE WAY IN WHICH AN ENGINE IS TESTED WITHOUT RESORTING TO
USING A PROGRAMMER

859721   B7606229, C7604547
  THE MEASUREMENT OF AVERAGE INDICATOR DIAGRAMS BY A MINICOMPUTER
AIDED DATA ACQUISITION SYSTEM
  KONTANI, K.   ; MECH. ENGNG. LAB., AGENCY OF INDUSTRIAL SCI. AND
TECHNOL., IGUSA SUGINAMI-KU, TOKYO, JAPAN
  J. MECH. ENG. LAB. (JAPAN)   VOL.29, NO.3   92-108   MAY 1975
CODEN: KGKSBL
  DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, DATA ACQUISITION
, INTERNAL COMBUSTION ENGINES
  IDENTIFIERS: AVERAGE INDICATOR DIAGRAMS, MINICOMPUTER AIDED DATA
ACQUISITION SYSTEM, CONTINUOUS ENGINE CYCLES, IGNITION TIMING, PRECISE
MEASUREMENT
  SECTION CLASS CODES: C8847, B4270, C7660
  UNIFIED CLASS CODES: WMEMAD, BECRAX
  LANGUAGE: JAPANESE
  THE SYSTEM YIELDS A MEAN PRESSURE TRACE FOR A CERTAIN NUMBER OF
CONTINUOUS ENGINE CYCLES AND, AT THE SAME TIME, RECORDS THE MAXIMUM
PRESSURE, THE MAXIMUM RATE OF PRESSURE RISE AND THE IGNITION TIMING OF
EACH CYCLE, THUS ACCOMPLISHING A PRECISE MEASUREMENT OF AN INDICATOR
DIAGRAM. THE DETAILED DESCRIPTION OF THE METHOD AS WELL AS THE
DISCUSSION OF THE PROBLEMS ACCOMPANYING THE AVERAGING TREATMENT ARE
SHOWN   (4 REFS)

858815 B7607584, C7603563
DRIVING SIMULATOR FOR FAST TRAINS
CARMINATI, E.
TECNOL. ELETTR. (ITALY) NO.6 72-7 JUNE 1975
DESCRIPTORS: RAILWAYS, SIMULATION, TRAINING, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS
 IDENTIFIERS: FAST TRAINS, ENGINE CONTROLS, SIGNAL VISUALISATION,
NOISE SIMULATION, DRIVING SIMULATOR, COMPUTER CONTROL
 SECTION CLASS CODES: B5620, B1220, C7872, C7600, C8846
 UNIFIED CLASS CODES: TKEAAR, ADCAAP, VHREAK, VKZAAS, WHEKAS
 LANGUAGE: ITALIAN
 TRAINING FOR DRIVERS OF TRAINS OF 200 KM/H REQUIRES EXPERIENCE
SUPPLEMENTED BY PRACTICE IN A SIMULATOR AS IN THE TRAINING OF
AIR-PILOTS. A SIMULATOR MADE BY E. MARELLI CO. FOR THE ITALIAN
RAILWAYS IS DESCRIBED; IT PROVIDES FOR DRIVING IN DAY AND NIGHT
CONDITIONS, ENGINE CONTROLS AND SAFETY MATTERS, SIGNAL VISUALISATION
AND NOISE SIMULATION, DATA GENERATION, SUPERVISION AND RECORDING OF
DRIVER PERFORMANCE. THE SIMULATOR IS CONTROLLED BY A PDP/8/E COMPUTER

858548 C7603265
CONTROL SYSTEM OF THE ANALOGUE-DIGITAL-ANALOGUE TYPE WITH A DIGITAL
COMPUTER HAVING MULTIPLE FUNCTIONS FOR AN AUTOMATIC VEHICLE
 RIVERE, J.-P., BERTUOL, B., LEICHLE, C.
 PATENT NO.: USA 3906207 ASSIGNEES: REGIE NAT. USINES RENAULT,
AUTOMOBILES PEUGEOT FILED: 10 MAY 1973
 ORIGINAL PATENT APPL. NO.: FRANCE 72.16823
 PRIORITY DATE: 10 MAY 1972
 16 SEPT. 1975
 DESCRIPTORS: AUTOMOBILES, ENGINES, DIGITAL CONTROL, CONTROL
ENGINEERING APPLICATIONS OF COMPUTERS, ANALOGUE-DIGITAL CONVERSION,
DIGITAL-ANALOGUE CONVERSION
 IDENTIFIERS: DIGITAL COMPUTER, MULTIPLE FUNCTIONS, AUTOMATIC VEHICLE
, 10 BINARY DIGITS, A/D/A CONTROL SYSTEM, ENGINE CONTROL
 SECTION CLASS CODES: C7851, C8846
 UNIFIED CLASS CODES: VMKCAD, WHEKAS
 ENGINE CONTROL SIGNALS ARE CALCULATED BY A UNIT CAPABLE OF
MULTIPLYING AND ADDING TWO NUMBERS OF UP TO 10 BINARY DIGITS AND
STORING THE SUM IN A READ-WRITE MEMORY

858408   A7607515, B7606350, C7603100
  DIGITAL QUARTZ TRANSDUCERS FOR ABSOLUTE PRESSURE MEASUREMENTS
  PAROS, J.M.   ; PAROSCI. INC., REDMOND, WA, USA
  WASHBURN, B.
  ; ISA
  STD BOOK NO.: 0 87664 261 X
  PROCEEDINGS OF THE 21ST INTERNATIONAL INSTRUMENTATION SYMPOSIUM
435-42 1975
  19-21 MAY 1975   ISA   PHILADELPHIA, PA., USA
  PUBL: ISA   PITTSBURGH, PA., USA
  DESCRIPTORS: PRESSURE TRANSDUCERS, PRESSURE MEASUREMENT
  IDENTIFIERS: ABSOLUTE PRESSURE MEASUREMENTS, QUARTZ CRYSTAL SENSING
ELEMENT, OCEANOGRAPHY, METEOROLOGY, JET ENGINE TESTING, PROPULSION
CONTROL SYSTEMS, AIR DATA COMPUTERS, LABORATORY PRESSURE STANDARDS,
DIGITAL QUARTZ TRANSDUCERS
  SECTION CLASS CODES: B4449, C7449, B4250, C7630, A0630
  UNIFIED CLASS CODES: BKETAH, BECMAA, BGGAAV
  THE CONSTRUCTION, OPERATION, AND PERFORMANCE OF A SERIES OF ABSOLUTE
PRESSURE TRANSDUCERS WHICH EMPLOY A SPECIAL QUARTZ CRYSTAL SENSING
ELEMENT ARE DESCRIBED. THE RESONANT FREQUENCY OF THE QUARTZ CRYSTAL
VARIES WITH PRESSURE INDUCED STRESS AND THE ULTRA-HIGH VACUUM IN WHICH
THE RESONATOR OPERATES IS USED AS THE ABSOLUTE PRESSURE REFERENCE.
BECAUSE OF THEIR DIGITAL-TYPE OUTPUT, HIGH ACCURACY, LOW POWER
CONSUMPTION, AND INSENSITIVITY TO ENVIRONMENTAL ERRORS, THESE
INSTRUMENTS HAVE BEEN USED SUCCESSFULLY IN SUCH DIVERSE FIELDS AS
OCEANOGRAPHY, METEOROLOGY, JET ENGINE TESTING PROPULSION CONTROL
SYSTEMS, AIR DATA COMPUTERS, AND LABORATORY PRESSURE STANDARDS   (3
REFS)

847735   C7602019
  DIGITAL COMPUTING TECHNIQUES IN THE MANUFACTURE AND OPERATION OF
ENGINE MANAGEMENT SYSTEMS
  DAVIES, R.J.   ; LUCAS AEROSPACE LTD., SOLIHULL, ENGLAND
  AERONAUT. J. (GB)   VOL.79, NO.776   349-53   AUG. 1975   CODEN:
AENJAK
  DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, AEROSPACE ENGINES,
AUTOMATIC TESTING, MANUFACTURING ADMINISTRATIVE DATA PROCESSING
  IDENTIFIERS: ENGINE MANAGEMENT SYSTEMS, DIGITAL TECHNIQUES, ENGINE
CONTROL, STORE INFORMATION, SELF TEST PROGRAMMES, INTERNAL FAULT
DIAGNOSIS
  SECTION CLASS CODES: C8849, C7875, C8670
  UNIFIED CLASS CODES: WMEZAN, VHRMAY, WKKAAH
  INTRODUCES THE DIGITAL TECHNIQUE IN ENGINE CONTROL LEADING TO MANY
ADVANTAGES. THE ABILITY OF DIGITAL SYSTEMS TO STORE INFORMATION MEANS
THAT CALIBRATION AND TEST PROGRAMMES CAN BE PERFORMED USING
INFORMATION DERIVED FROM THE EARLY STAGES OF PRODUCTION. WIDE RANGING
SELF TEST PROGRAMMES CAN ALSO BE INCLUDED, AS CAN DIAGNOSIS OF
INTERNAL FAULTS

847731   C7602015
   COMPUTER AIDED DESIGN OF THE EXHAUST OF A TURBOCHARGED DIESEL ENGINE
   LEDGER, J.D.   ; INST. OF SCI. AND TECHNOL., UNIV. OF MANCHESTER,
MANCHESTER, ENGLAND
   STD BOOK NO.: 0 903796 06 6
   INTERACTIVE SYSTEMS   171-81   1975
   SEPT. 1975   LONDON, ENGLAND
   PUBL: ONLINE   UXBRIDGE, MIDDX., ENGLAND
   DESCRIPTORS: INTERNAL COMBUSTION ENGINES, MECHANICAL ENGINEERING,
COMPUTER-AIDED DESIGN
   IDENTIFIERS: TURBOCHARGED DIESEL ENGINE, COMPRESSIBLE GAS FLOWS,
EXHAUST PIPE,   DISPLAY   FACILITIES, BOUNDARY CONDITIONS, DESIGN
FACILITIES, FINAL PROGRAM SUITE, CHANGES IN ENGINE, TURBOCHARGER
PARAMETERS, FLOW EQUATIONS, MULTI PIPE EXHAUST SYSTEMS, CAD
   SECTION CLASS CODES: C8847
   UNIFIED CLASS CODES: WMEMAD

   DEVELOPMENT   OF   A   DESIGN   SUITE FOR STUDYING THE UNSTEADY,
COMPRESSIBLE GAS FLOWS IN THE EXHAUST PIPE OF A TURBOCHARGED DIESEL
ENGINE IS DISCUSSED. INTERACTION AND DISPLAY FACILITIES WHICH COULD
GREATLY ASSIST THE ENGINE DESIGNER ARE INCORPORATED. FOLLOWING A
REVIEW OF THE METHOD OF SOLUTION EMPLOYED AND THE BOUNDARY CONDITIONS
RELEVANT TO THIS APPLICATION, DETAILS OF THE INTERACTION AND DESIGN
FACILITIES AND THE STRUCTURE OF THE FINAL PROGRAM SUITE ARE PRESENTED.
EXAMPLES OF THE USE OF THE SUITE FOR STUDYING CHANGES IN ENGINE,
EXHAUST PIPE AND TURBOCHARGER PARAMETERS ARE GIVEN FOR TWO ENGINES. AN
EXTENSION TO THE DESIGN SUITE IS BRIEFLY DISCUSSED IN WHICH AN
ALTERNATIVE METHOD OF SOLUTION OF THE FLOW EQUATIONS IS INCORPORATED
AS AN ADDITIONAL MODULE. FINALLY, RECOMMENDATIONS ARE MADE FOR FURTHER
EXTENDING THE DESIGN FACILITIES TO ACCOMMODATE COMPLEX MULTI PIPE
EXHAUST SYSTEMS, AS THE USE OF COMPUTER-AIDED DESIGN TECHNIQUES WOULD
SHOW EVEN GREATER BENEFIT TO THE ENGINE DESIGNER FOR SUCH SYSTEMS (8
 REFS)

847579   A7600290, C7601842
MULTIELEMENT ANALYSIS VIA COMPUTER-CONTROLLED RAPID-SCAN ATOMIC
FLUORESCENCE SPECTROMETER WITH A CONTINUUM SOURCE
   JOHNSON, D.J., PLANKEY, F.W., WINEFORDNER, J.D.   ; DEPT. OF CHEM.,
UNIV. OF FLORIDA, GAINESVILLE, FL, USA
   ANAL. CHEM. (USA)   VOL.47, NO.11   1739-43   SEPT. 1975   CODEN:
ANCHAM
   DESCRIPTORS: SPECTROCHEMICAL ANALYSIS, SPECTROMETER COMPONENTS AND
ACCESSORIES, SPECTROCHEMICAL ANALYSIS, SPECTROSCOPY APPLICATIONS OF
COMPUTERS
   IDENTIFIERS: CONTINUUM SOURCE, TRACE WEAR METALS, JET ENGINE
LUBRICATING OILS, AG, AU, CD, CR, CO, CU, FE, IN, MG, MN, NI, PB, PD,
PT, SN, SR, TL, ZN, AL, BE, MO, TI, V, DETECTION LIMITS, COMPUTER
CONTROLLED RAPID SCAN SLEWED SCAN ATOMIC FLUORESCENCE SPECTROMETER,
MULTIELEMENT ANALYSIS, EIMAC XE ARC EXCITATION SOURCE, ACETYLENE FLAME
, DETECTION LIMIT, ANALYTICAL CURVE, JET ENGINE LUBRICATING OIL, AIR
FORCE AVERAGE TRACE METAL CONTENT VALUES
   SECTION CLASS CODES: A0695, A0693, C8816
   UNIFIED CLASS CODES: BGZMGP, BGZGAZ, WMCKAC
   A VERSATILE, SIMPLE, RELATIVELY INEXPENSIVE COMPUTER-CONTROLLED,
SLEWED-SCAN SPECTROMETER WITH A SINGLE EIMAC XENON ARC EXCITATION
SOURCE, AND AN ACETYLENE (AIR OR N/SUB 2/O) FLAME IS DESCRIBED AND
USED FOR MULTIELEMENT ANALYSIS OF TRACE WEAR METALS IN JET ENGINE
LUBRICATING OILS. ANALYTICAL FIGURES OF MERIT OBTAINED FOR 18 ELEMENTS
(AG, AU, CD, CR, CO, CU, FE, IN, MG, MN, NI, PB, PD, PT, SN, SR, TL,
ZN) MEASURED WITH A SEPARATED AIR/ACETYLENE FLAME AND THE EIMAC SOURCE
AND FOR 5 ELEMENTS (AL, BE, MO, TI, AND V) WITH A SEPARATED N/SUB
2/O/ACETYLENE FLAME AND THE SAME EIMAC SOURCE ARE LISTED. THE
DETECTION LIMITS OBTAINED ARE COMPARABLE TO THE BEST VALUES OBTAINED
BY FLAME ATOMIC ABSORPTION SPECTROMETRY WITH SINGLE ELEMENT HOLLOW
CATHODE LAMPS   (7 REFS)

846519   C7600747
  SENSING AND INPUT SYSTEM FOR COMPUTER CONTROL OF IC ENGINE
  PATENT NO.:   UK   1400614   ASSIGNEES: RENAULT AND PEUGEOT   FILED:
13 JUNE 1972
  ORIGINAL PATENT APPL. NO.: FRANCE   71.21514
  PRIORITY DATE: 14 JUN 1971
  16 JULY 1975
  DESCRIPTORS: INTERNAL   COMBUSTION   ENGINES,   ANGULAR   VELOCITY
MEASUREMENT, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS, ELECTRIC
SENSING DEVICES, SIGNAL PROCESSING
  IDENTIFIERS: COMPUTER CONTROL, INTERNAL COMBUSTION ENGINE, TOOTHED
RING, FLYWHEEL, PULSE TRAIN, ENGINE SPEED, SENSORS, ANGULAR POSITION,
CRANKSHAFT, SIGNAL PROCESSING CIRCUITRY
  SECTION CLASS CODES: C7851, C8846, C7441, C7442
  UNIFIED CLASS CODES: VHKCAD, WHEKAS, BKECAB, BKEEAM
  THE SYSTEM IS OPERATIVE WITH AN INTERNAL COMBUSTION ENGINE HAVING A
TOOTHED RING MOUNTED ON THE FLYWHEEL FOR ENGAGEMENT BY THE PINION OF A
STARTER MOTOR. A FIRST SENSOR IS RESPONSIVE TO THE PASSAGE OF THE
TEETH TO PRODUCE A FIRST PULSE TRAIN, HAVING A FREQUENCY RELATED TO
THE ENGINE SPEED. SECOND AND THIRD SENSORS ARE RESPONSIVE TO COACTING
ELEMENTS MOUNTED ON THE FLYWHEEL. THESE ELEMENTS ARE DISPOSED IN
PRE-DETERMINED ANGULAR RELATIONSHIPS WITH THE ENGINE CRANKS ETC. AND
PRODUCE SIGNALS REPRESENTING THE ANGULAR POSITION OF THE CRANKSHAFT
ETC. AT GIVEN INSTANTS, THE SIGNALS FROM EACH OF THE SENSORS BEING FED
INTO SIGNAL PROCESSING CIRCUITRY

835469   B7543875, C7528449
  APPARATUS FOR DETERMINING THE GROSS THRUST OF A JET ENGINE
  PLETT, E.G.
  PATENT NO.: USA   3886790   ASSIGNEES: CONTROL DATA CANADA LTD
FILED: 18 MARCH 1974
  ORIGINAL PATENT APPL. NO.: CANADA   169738
  PRIORITY DATE: 27 APR 1973
  3 JUNE 1975
  DESCRIPTORS: AEROSPACE ENGINES, GAS TURBINES, PRESSURE MEASUREMENT,
AEROSPACE APPLICATIONS OF COMPUTERS
  IDENTIFIERS: GROSS THRUST, JET ENGINE, NOZZLE TOTAL PRESSURE,
DIFFUSER, STATIC PRESSURES, NOZZLE ENTRANCE, COMPUTER
  SECTION CLASS CODES: C8849, C7851, B4720
  UNIFIED CLASS CODES: WHEZAN, VHKCAD, ZLEAAZ
  THE APPARATUS COMPUTES THE NOZZLE TOTAL PRESSURE FROM MEASUREMENTS
OF THE TOTAL PRESSURE IN THE DIFFUSER AND OF THE STATIC PRESSURES AT
THE NOZZLE ENTRANCE AND ON THE UPSTREAM SIDE OF THE DIFFUSER

835458　B7540413, C7528438
COMPUTERIZED DIAGNOSTIC TESTER AT HAND
O;HARA, J.P., ASHTON, D.N., KRAMER, L.L.　; DETROIT EDISON CO.,
DETROIT, MI, USA
ELECTR. WORLD　(USA)　VOL.184, NO.3　36-50　1 AUG. 1975　CODEN:
ELWOA3
DESCRIPTORS: AUTOMOBILES, MAINTENANCE ENGINEERING, COMPUTER-AIDED
ANALYSIS, AUTOMATIC TEST EQUIPMENT
IDENTIFIERS: ENGINE, AUTOMOBILES, TRUCKS, MAINTENANCE, COMPUTERISED
DIAGNOSTIC TESTER
SECTION CLASS CODES: B1263, B5620, C8849
UNIFIED CLASS CODES: ADGDAL, TKEAAR, WMEZAN
A NEW, COMPUTER-RUN ENGINE DIAGNOSTIC SYSTEM THAT TELLS WHAT TO FIX,
AND HAS THE POTENTIAL TO ELIMINATE COSTLY, TIME-CONSUMING
TRIAL-AND-ERROR REPAIRS OF AUTOMOBILES AND TRUCKS, IS CURRENTLY BEING
EVALUATED BY CONSOLIDATED EDISON CO. IN A CONCERTED EFFORT TO MINIMIZE
FLEET-MAINTENANCE COSTS WHILE OPTIMIZING FUEL USAGE. THE TESTER,
DEVELOPED BY HAMILTON TEST SYSTEMS (HTS), A SUBSIDIARY OF UNITED
TECHNOLOGIES CORP, AUTOMATICALLY CHECKS ELECTRICAL, EXHAUST EMISSION,
AND OTHER ENGINE CONDITIONS, DETERMINES WHAT IS WRONG, AND DECIDES
WHAT PARTS HAVE TO BE REPAIRED, ADJUSTED, OR REPLACED. ITS COMPUTER
THEN ISSUES A PRINTOUT, WHICH PROVIDES ALL THIS INFORMATION BOTH TO
THE MECHANIC AND TO FLEET MANAGEMENT

833711　C7526451
MODELLING ENGINE STATIC STRUCTURES WITH CONICAL SHELL FINITE
ELEMENTS
KIELB, R.E.　; AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AIR
FORCE BASE, OH, USA
J. AIRCR. (USA)　VOL.12, NO.4　230-3　APRIL 1975　CODEN: JAIRAM
DESCRIPTORS: FINITE ELEMENT ANALYSIS, AEROSPACE ENGINES, MODELLING,
AEROSPACE APPLICATIONS OF COMPUTERS
IDENTIFIERS: ENGINE STATIC STRUCTURES, CONICAL SHELL FINITE ELEMENTS
, NONSYMMETRIC LOADING, COMPUTER TIME, AZIMUTHAL COORDINATE, STRESS,
NONSYMMETRIC DISPLACEMENT, FOURIER SERIES, STANDARD PLATE MODEL,
STANDARD BEAM MODEL, MODELLING
SECTION CLASS CODES: C6420, C8849, C8200
UNIFIED CLASS CODES: VCEAAX, WMEZAN, DLTAAE
THE CONICAL SHELL ELEMENT WITH NONSYMMETRIC LOADING AND DISPLACEMENT
CAPABILITIES HAS EXCELLENT POSSIBILITIES FOR APPLICATION TO ENGINE
STATIC STRUCTURES. THE MAJOR BENEFIT WOULD BE A DRAMATIC REDUCTION IN
COMPUTER TIME AS COMPARED WITH A PLATE MODEL, HOWEVER, A SEVERE
LIMITATION IS THE INABILITY TO COMBINE THIS ELEMENT WITH ANY OTHER
ELEMENT TYPES. A TECHNIQUE IS SHOWN THAT CAN BE USED TO BYPASS THIS
ELEMENT COMPATIBILITY PROBLEM. THE INHERENT DIFFICULTY LIES IN THE
DEGREE-OF-FREEDOM PECULIARITIES OF THE CONICAL SHELL ELEMENT. THE
NONSYMMETRIC MOTION OF THIS ELEMENT IS ACCOMPLISHED BY EXPANDING EACH
DEGREE OF FREEDOM IN A FOURIER SERIES WITH RESPECT TO THE AZIMUTHAL
COORDINATE. THE TECHNIQUE PRESENTED SUMS THIS FOURIER SERIES FOR EACH
DEGREE OF FREEDOM AND CONNECTS IT TO THE APPROPRIATE DEGREE OF FREEDOM
FOR THE NONSHELL PORTIONS OF THE STRUCTURE BY USING FUNCTIONAL
CONSTRAINTS. THE METHODS USED TO MAKE THE ELEMENTS COMPATIBLE AND THE
COMPUTER TIME, DISPLACEMENT, AND STRESS COMPARISONS WITH STANDARD
PLATE AND BEAM MODELS WILL BE SHOWN　(3 REFS)

821950   C7525494
    NUMERICALLY-EXPERIMENTAL STUDY ON THE COMBUSTION AND PERFORMANCE OF
A SPARK-IGNITION ENGINE. 4 CYCLE ENGINE
    HATTA, K., SANO, T. ; INST. OF SPACE AND AERONAUTICAL SCI., UNIV.
TOKYO, TOKYO, JAPAN
    BULL. INST. SPACE AND AERONAUT. SCI. UNIV. TOKYO A (JAPAN)   VOL.10,
NO.4A   715-54   OCT. 1974   CODEN: TDUHAD
    DESCRIPTORS: INTERNAL COMBUSTION ENGINES, AIR POLLUTION, SIMULATION,
ENGINEERING APPLICATIONS OF COMPUTERS
    IDENTIFIERS: SPARK IGNITION ENGINE, ATMOSPHERIC POLLUTANT NO,
COMBUSTION PROCESS, FLAME PROPAGATION, SIMULATION MODEL, N-OCTANE,
NUMERICAL EXPERIMENTAL STUDY, FOUR CYCLE ENGINE, DIGITAL COMPUTER
ANALYSIS
    SECTION CLASS CODES: C8847
    UNIFIED CLASS CODES: WMEMAD
    LANGUAGE: JAPANESE
    DIGITAL COMPUTER ANALYSIS OF THE PERFORMANCE OF A SPARK IGNITION
ENGINE AND THE SUBSEQUENT FORMATION OF THE ATMOSPHERIC POLLUTANT NO
PRESENTS A BETTER UNDERSTANDING OF THE COMBUSTION PROCESS BASED ON THE
ONE-DIMENSIONAL THEORY OF FLAME PROPAGATION UNDER THE HEAT EXCHANGING
BETWEEN WALLS AND GAS IN THE CYLINDER. BECAUSE OF MAJOR INTEREST IN
THE COMBUSTION PROCESS FOR THE PRESENTATION OF A NUMERICAL SIMULATION
MODEL, THE GAS EXCHANGE PROCESS IS SIMPLY ASSUMED TO BE OF THE
IDEALIZED INDICATOR DIAGRAM. AS THE FUEL, N-OCTANE AND AS THE
COMPONENTS OF THE BURNED GAS, ELEVEN SPECIES, CO, CO/SUB 2/, H, H/SUB
2/, H/SUB 2/O, N, N/SUB 2/, NO, O, O/SUB 2/ AND OH ARE CONSIDERED TO
BE IN CHEMICAL EQUILIBRIUM EXCEPT FOR NO WHOSE FORMATION IS PREDICTED
BY ZELDOVICH MECHANISM   (4 REFS)

820772   C7524130
    CONTROL SYSTEM FOR INTERNAL COMBUSTION ENGINE
    PATENT NO.: UK   1395027   ASSIGNERS: CHANTIERS ATLANTIQUES   FILED:
12 APRIL 1972
    ORIGINAL PATENT APPL. NO.: FRANCE   13341
    PRIORITY DATE: 15 APR 1971
    21 MAY 1975
    DESCRIPTORS: INTERNAL   COMBUSTION   ENGINES,   CONTROL   ENGINEERING
APPLICATIONS OF COMPUTERS
    IDENTIFIERS: INTERNAL COMBUSTION ENGINE, CONTROL MEMBERS, CRANKSHAFT
, COMPUTER, CONTROL INSTRUCTION, REFERENCE POSITION, ENGINE SPEED,
VALVES, FUEL INJECTION PUMPS, ENGINE LOAD, ENGINE TEMPERATURE
    SECTION CLASS CODES: C7851, C8846
    UNIFIED CLASS CODES: VMKCAD, WMEKAS
    THE   SYSTEM   ACTS   ON   THE   MOTIONS OF CONTROL MEMBERS WHOSE
DISPLACEMENTS ARE A FUNCTION OF ROTATION OF THE ENGINE CRANKSHAFT. THE
CONTROL IS EFFECTED THROUGH A COMPUTER, WITH SIGNALS REPRESENTING
CONTROL INSTRUCTION AND THE ANGULAR POSITION OF THE CRANKSHAFT
RELATIVE TO A REFERENCE POSITION, AND PREVAILING CONDITIONS IN THE
ENGINE. THESE CONDITIONS INCLUDE ENGINE SPEED, LOAD AND ENGINE
TEMPERATURE: THE CONTROL SIGNALS FROM THE COMPUTER ACT ON THE INLET
AND EXHAUST VALVES AND FUEL INJECTION PUMPS

810343　B7535772, C7522632
GAS EXCHANGE CALCULATIONS: TURBINE AND ENGINE VALVE BOUNDARY
CONDITIONS. APPLICATIONS AND CORRELATIONS WITH ENGINE TEST DATA
BULATY, T.　　;　BBC AKTIENGESELLSCHAFT BROWN, BOVERI CIE, BADEN,
SWITZERLAND
INT. J. MECH. SCI. (GB)　VOL.17, NO.5　325-37　MAY 1975　CODEN:
IMSCAW
DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, BOUNDARY-VALUE
PROBLEMS, GAS TURBINES, VALVES
IDENTIFIERS: GAS EXCHANGE CALCULATIONS, ENGINE VALVE, BOUNDARY
CONDITIONS, ENGINE TEST DATA, COMPUTER PROGRAMS, THERMODYNAMIC MODEL,
TURBOCHARGER TURBINE, MATHEMATICAL REPRESENTATION, TIMING
SECTION CLASS CODES: C8847, B5244, C7851
UNIFIED CLASS CODES: WHEMAD, TEGEAT, VMKCAD
WHEN INVESTIGATING THE COMBINED OPERATION OF INTERNAL COMBUSTION
ENGINES AND TURBOCHARGERS, COMPUTER PROGRAMS ARE USED TO CALCULATE THE
GAS EXCHANGE PROCESS, FOR WHICH ASSUMPTIONS OF VARYING COMPLEXITY ARE
MADE. APART FROM A THERMODYNAMIC MODEL FOR THE CYLINDERS AND PIPING,
SUCH PROGRAMS REQUIRE BOUNDARY CONDITIONS FOR THE SYSTEM OF EXHAUST
PIPING, I.E. APPROPRIATE DESCRIPTIONS OF THE TURBOCHARGER TURBINE AND
THE ENGINE VALVE SYSTEM. THE MATHEMATICAL REPRESENTATION OF THE
CHARACTERISTICS OF THE TURBOCHARGER TURBINES AND THE ENGINE VALVES ARE
COVERED. GENERAL RULES ARE DERIVED FOR THE CHOICE OF SUITABLE TIMING
FOR TURBOCHARGED FOUR-STROKE ENGINES, BASED ON THE COMPUTED
OPTIMIZATION OF THE VALVE TIMING, AND BY CORRELATING EXPERIMENTAL
RESULTS AND THE CHARACTERISTIC VALUES OF THE VALVES　(12 REFS)

785175　C7516497
DIGITAL INTEGRATED CONTROL OF A MACH 2.5 MIXED-COMPRESSION
SUPERSONIC INLET AND AN AUGMENTED MIXED-FLOW TURBOFAN ENGINE
BATTERTON, P.G., ARPASI, D.J., BAUMBICK, R.J.
REPORT NO.: NASA-TM-X-3075　ISSUED BY: NASA, CLEVELAND, OHIO, USA
OCT. 1974
DESCRIPTORS: AEROSPACE ENGINES, DIGITAL CONTROL, AEROSPACE CONTROL
IDENTIFIERS: MACH 2.5, MIXED COMPRESSION SUPERSONIC INLET, MIXED
FLOW TURBOFAN ENGINE, DIGITAL CONTROL, AEROSPACE ENGINES, DIGITAL
INTEGRATED CONTROL
SECTION CLASS CODES: C7875
UNIFIED CLASS CODES: VMRMAY
AVAILIABILITY: NTIS SPRINGFIELD, VA. 22151, USA
A DIGITALLY IMPLEMENTED INTEGRATED INLET-ENGINE CONTROL SYSTEM WAS
DESIGNED AND TESTED ON A MIXED-COMPRESSION, AXISYMMETRIC, MACH 2.5
SUPERSONIC INLET WITH 45 PERCENT INTERNAL SUPERSONIC AREA CONTRACTION
AND A TF30-P-3 AUGMENTED TURBOFAN ENGINE. THE CONTROL MATCHED ENGINE
AIRFLOW TO AVAILABLE INLET AIRFLOW. BY MONITORING INLET TERMINAL SHOCK
POSITION AND OVER-BOARD BYPASS DOOR COMMAND, THE CONTROL ADJUSTED
ENGINE SPEED SO THAT IN STEADY STATE, THE SHOCK WOULD BE AT THE
DESIRED LOCATION AND THE OVERBOARD BYPASS DOORS WOULD BE CLOSED.
DURING ENGINE-INDUCED TRANSIENTS, SUCH AS AUGMENTOR LIGHT-OFF AND
CUTOFF, THE INLET OPERATING POINT WAS MOMENTARILY CHANGED TO A MORE
SUPERCRITICAL POINT TO MINIMIZE UNSTARTS. THE DIGITAL CONTROL ALSO
PROVIDED AUTOMATIC INLET RESTART. A VARIABLE INLET THROAT BLEED
CONTROL BASED ON THROAT MACH NUMBER, PROVIDED ADDITIONAL INLET
STABILITY MARGIN

784536   C7515757
THE DEVELOPMENT OF A COMPUTER MODEL FOR PREDICTION OF THE US TRUCK
AND BUS POPULATION, FUEL USAGE, AND AIR POLLUTION CONTRIBUTION
    TINGLEY, D.S., JOHNSON, J.H.   ; MICHIGAN TECHNOL. UNIV., USA
VOGT, W.G., MICKLE, M.H.
MODELLING AND SIMULATION, VOL.4   53-8   1973
23-24 APRIL 1973 PITTSBURGH, PA., USA
PUBL: ISA   PITTSBURGH, PA., USA
DESCRIPTORS: TRANSPORTATION,   ROAD   VEHICLES,   AIR   POLLUTION,
SIMULATION
    IDENTIFIERS: TRANSPORTATION, SIMULATION, COMPUTER MODEL, TRUCK, BUS
POPULATION, FUEL USAGE, AIR POLLUTION CONTRIBUTION, VEHICLE PRODUCTION
PROJECTIONS, ENGINE, VEHICLE WEIGHT, 1932 TO THE YEAR 2000, DIESEL,
GASOLINE
    SECTION CLASS CODES: C6420, C7871
    UNIFIED CLASS CODES: VCEAAX, VHRCAZ
    USING   NEW VEHICLE PRODUCTION PROJECTIONS, THE MODEL COMPUTES TRUCKS
IN   THE   POPULATION   BY   TYPE   OF   ENGINE (GASOLINE OR DIESEL), GROSS
VEHICLE   WEIGHT   AND   BY   AGE.   FROM   THESE   DATA   IT   CALCULATES   THE
RESPECTIVE   CO,   HC,   NO/SUB X/,   CO/SUB 2/   AND   PARTICULATE MATTER
EMISSIONS AND THE FUEL USAGE BY VARIOUS VEHICLES. THE MODEL COVERS THE
TIME   PERIOD FROM 1932 TO THE YEAR 2000. VARIOUS PUBLISHED POPULATION,
FUEL   USAGE, SCRAPPAGE, AND SALES DATA ARE USED TO VERIFY THE ACCURACY
OF THE MODEL. THE MODEL IS DEVELOPED TO THE POINT OF ITS VERIFICATION.
CONCLUSIONS   ABOUT   THE   AIR   POLLUTION   AND   FUEL USAGE OF DIESEL AND
GASOLINE POWERED TRUCKS ARE DRAWN FROM THE MODEL RESULTS   (10 REFS)

772877   C7514820
THE   INFLUENCE   OF   AVIONIC   SYSTEM REQUIREMENT ON AIRBORNE COMPUTER
DESIGN
    SHEPHERD,   J.T.   ; MARCONI-ELLIOTT AVIONIC SYSTEMS LTD., ROCHESTER,
ENGLAND
    ; AGARD
AGARD   CONFERENCE   PROCEEDINGS   NO.149   ON   REAL TIME COMPUTER BASED
SYSTEMS   28/1-21   1974
    27-31 MAY 1974   AGARD   ATHENS, GREECE
    PUBL: AGARD   NEUILLY SUR SEINE, FRANCE
    DESCRIPTORS: AEROSPACE   APPLICATIONS   OF COMPUTERS, SPECIAL PURPOSE
COMPUTERS
    IDENTIFIERS: AUTOPILOTS   SYSTEMS,   AVIONIC   SYSTEM REQUIREMENT,
AIRBORNE COMPUTER DESIGN, CONSTRAINTS, SYSTEM PERFORMANCE REQUIREMENTS
, AIRCRAFT OPERATIONAL ECONOMIC ENVIRONMENT, AIR DATA SYSTEMS, FLIGHT
DIRECTOR SYSTEMS, HEAD UP, WEAPON DELIVERY SYSTEMS, NAVIGATION SYSTEMS
, CENTRAL MANAGEMENT SYSTEMS, ENGINE CONTROL SYSTEMS
    SECTION CLASS CODES: C8849, C9840
    UNIFIED CLASS CODES: WHEZAN, XREAAF
    THIS   PAPER   EXAMINES   THE   CONSTRAINTS   IMPOSED   UPON   THE AIRBORNE
COMPUTER   DESIGNER   BY   THE   SYSTEM   PERFORMANCE   REQUIREMENTS AND THE
AIRCRAFT   OPERATIONAL   ECONOMIC ENVIRONMENT. IN ORDER TO EXAMINE THESE
REQUIREMENTS A NUMBER OF TYPICAL SYSTEMS ARE CONSIDERED

771969   F7522914, C7513821
THYRISTOR DRIVE SYSTEM FOR A TESTING STAND OF AIRCRAFT ENGINE FUEL
SYSTEMS
  LASTOWIECKI, J., DUSZCZYK, K.   ; POLITECHNIKA WARSZAWSKA, POLAND
  PRZEGL. ELEKTROTECH. (POLAND)   VOL.51, NO.1   11-13   JAN. 1975
CODEN: PZELAL
  DESCRIPTORS: THYRISTOR APPLICATIONS, ELECTRIC DRIVES, AUTOMATIC TEST
EQUIPMENT,   AIRCRAFT,   AEROSPACE   CONTROL,   CONTROL   ENGINEERING
APPLICATIONS OF COMPUTERS
  IDENTIFIERS: OPTIMAL CONTROLLER SETTING, DIRECT CURRENT DRIVE SYSTEM
, AEROSPACE CONTROL, AUTOMATIC TEST EQUIPMENT, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS, THYRISTOR DRIVE SYSTEM, TESTING STAND,
AIRCRAFT ENGINE FUEL SYSTEMS, ELECTRONIC REGULATORS, COMPUTER
CONTROLLED 30 KW MOTOR
  SECTION CLASS CODES: C7875, C8846, C7856, B5620
  UNIFIED CLASS CODES: VMRMAY, WMEKAS, VMKKAR, TKEAAR
  LANGUAGE: POLISH
  A METHOD OF DESIGNING A DRIVING SYSTEM FOR A TESTING STAND OF
AIRCRAFT ENGINE FUEL SYSTEMS IS DISCUSSED. THE RELATIONSHIPS FOR AN
OPTIMUM CHOICE OF THE SETTINGS OF ELECTRONIC REGULATORS ARE GIVEN. THE
RESULTS OF TESTS ON A D.C. DRIVE SYSTEM WITH A COMPUTER CONTROLLED 30
KW MOTOR IS DISCUSSED   (3 REFS)

771954   B7522915, C7513806
  COMPUTERS ON MERCHANT SHIPS. II
  POLET, T.W., POLET, T.W., JR.
  POLITECH. TIJDSCHR. ELEKTROTECH. ELEKTRON. (NETHERLANDS)   VOL.30,
NO.5   149-55   5 MARCH 1975   CODEN: PTEEBR
  DESCRIPTORS: SHIPS, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS,
RADIONAVIGATION, COMMUNICATIONS APPLICATIONS OF COMPUTERS, PROCESS
COMPUTERS
  IDENTIFIERS: ONLINE OPERATION, OFF LINE OPERATION, CONTROL
ENGINEERING APPLICATIONS OF COMPUTERS, RADIONAVIGATION, COMMUNICATIONS
APPLICATIONS OF COMPUTERS, MERCHANT SHIPS, PROCESS CONTROL COMPUTERS,
ENGINE CONTROL AND MAINTENANCE, SHIPBOARD TRIALS, COLLISION PREVENTION
COMPUTER SIDED SYSTEMS, INTEGRATED NAVIGATION SYSTEMS, SOURCES OF
ERRORS
  SECTION CLASS CODES: B5620, C7874, C8846, C8842, B3660, C7850
  UNIFIED CLASS CODES: TKEAAR, VMRKAM, WMEKAS, WMEEAO, FGKAAZ, VMKAAS
  LANGUAGE: DUTCH
  FOR PT.I SEE IBID., VOL.30, NO.4, P.103 (1975). THE FUNCTION OF
ON-LINE AND OFF-LINE PROCESS CONTROL COMPUTERS IS ILLUSTRATED BY BLOCK
DIAGRAMS. IT IS SUGGESTED THAT THE APPLICATION OF COMPUTERS TO ENGINE
CONTROL AND MAINTENANCE IS EASIER THAN THEIR APPLICATION TO NAVIGATION
PROBLEMS. SOME SHIPBOARD TRIALS HAVE SHOWN UP POSSIBLE SOURCES OF
ERRORS. AS THE MOST USEFUL NAVIGATION AIDS, THE COLLISION PREVENTION
COMPUTER AIDED SYSTEMS ARE CONSIDERED. THE USE OF INTEGRATED
NAVIGATION SYSTEMS IS INCREASING

758985   C7512019
COMPUTER PROGRAM   TO PREDICT THE GAS EXCHANGE PROCESS OF A DIESEL
ENGINE
HALLAM, A.J., COTTAM, S. ; RUSTON PAXMAN DIESELS LTD., LINCOLN,
ENGLAND
COMPUT. AIDED DES. (GB)   VOL.7, NO.2   83-8   APRIL 1975   CODEN:
CAIDA5
DESCRIPTORS: COMPUTER-AIDED DESIGN, INTERNAL COMBUSTION ENGINES,
ENGINEERING APPLICATIONS OF COMPUTERS, THERMODYNAMICS
IDENTIFIERS: INTERNAL COMBUSTION ENGINES, COMPUTER AIDED DESIGN,
COMPUTER PROGRAM, PREDICT, GAS EXCHANGE PROCESS, DIESEL ENGINE,
THERMODYNAMIC PERFORMANCE, DATA PREPARATION
SECTION CLASS CODES: C8847
UNIFIED CLASS CODES: WMEMAD
RUSTON PAXMAN DIESELS LTD HAS MADE MUCH USE OF COMPUTER PROGRAMS IN
THE DEVELOPMENT OF DIESEL ENGINES, IN PARTICULAR FOR THE PREDICTION OF
THERMODYNAMIC PERFORMANCE. THE ORIGINAL PROGRAM FOR THIS PURPOSE HAS
UNDERGONE CONSIDERABLE CHANGE, BOTH TO IMPROVE THE ACCURACY AND EXTEND
THE APPLICATION. THESE CHANGES HAVE RESULTED IN THE PROGRAM BECOMING
UNNECESSARILY COMPLICATED FOR THE DESIGNER TO USE. BY RETURNING TO
FIRST PRINCIPLES A NEW PROGRAM HAS BEEN WRITTEN THAT IS CONSIDERABLY
MORE VERSATILE THAN THE OLD ONE, AND WHICH IS FAR SIMPLER TO USE
BECAUSE DATA PREPARATION IS NOW GOVERNED SOLELY BY THE COMPLEXITY OF
THE PROBLEM BEING TACKLED. THIS PROGRAM IS DESCRIBED   (7 REFS)

745056   E7513864
HOW UNCONVENTIONAL STIRLING ENGINES CAN HELP CONSERVE ENERGY
MARTINI, W.R., WHITE, M.A., DESTEESE, J.G. ; MCDONNELL DOUGLAS
CORP., RICHLAND, WASH., USA
; ASME, IEEE, ET AL
9TH INTERSOCIETY ENERGY CONVERSION ENGINEERING CONFERENCE
PROCEEDINGS   1092-9   1974
26-30 AUG. 1974   ASME, IEEE, ET AL. SAN FRANCISCO, CALIF., USA
PUBL: ASME   NEW YORK, USA
DESCRIPTORS: HEAT ENGINES
IDENTIFIERS: SINGLE VALVE CONTROL, DOUBLE STIRLING ENGINE CHILLER,
STIRLING ENGINES, FREE POWER PISTON, FREE DISPLACER, DRIED ORGANIC
MATTER, COMPUTER SIMULATIONS, ENGINE TESTS, SELF STARTING, DIRECT
HYDRAULIC POWER, VEHICLES, MECHANICAL POWER CONCEPT, THERMALLY
REGENERATIVE BRAKING, DESIGN CONCEPT, FLAT PLATE SOLAR COLLECTOR,
BUILDINGS
SECTION CLASS CODES: B5240
UNIFIED CLASS CODES: TEGAAX
UNCONVENTIONAL STIRLING ENGINES, WITH EITHER A FREE POWER PISTON OR
FREE DISPLACER, CAN EFFICIENTLY USE A WIDE VARIETY OF FUELS, INCLUDING
DRIED ORGANIC MATTER, A MAJOR UNUSED FUEL RESOURCE. BOTH COMPUTER
SIMULATIONS AND ENGINE TESTS HAVE DEMONSTRATED SELF STARTING AND
SINGLE-VALVE CONTROL OF AN ENGINE PRODUCING HYDRAULIC POWER FROM HEAT
WITHOUT INTERVENING SHAFT POWER. DIRECT HYDRAULIC POWER FOR VEHICLES
IS EVALUATED AS IS A MECHANICAL POWER CONCEPT PART PARTICULARLY
ATTRACTIVE BECAUSE OF THERMALLY REGENERATIVE BRAKING. FINALLY, A
DESIGN CONCEPT WHICH CAN USE 200 DEGREESF HEAT FROM A FLAT PLATE SOLAR
COLLECTOR OR HIGHER TEMPERATURE COMBUSTION HEAT SOURCES TO MORE
EFFICIENTLY PRODUCE HEATING AND COOLING FOR BUILDINGS THAN IS NOW
POSSIBLE   (4 REFS)

735401   C7506296
   APPLICATION OF FUZZY ALGORITHMS FOR CONTROL OF SIMPLE DYNAMIC PLANT
   MAMDANI, E.H.   : QUEEN MARY COLL., LONDON, ENGLAND
   PROC. INST. ELECTR. ENG. (GB)   VOL. 121 NO. 12   1585-8   DEC. 1974
    CODEN: PIEEAH
   DESCRIPTORS: HEAT ENGINES, CONTROL SYSTEMS, DIRECT DIGITAL CONTROL,
CONTROL ENGINEERING APPLICATIONS OF COMPUTERS
   IDENTIFIERS: LABORATORY BUILT STEAM ENGINE, APPLICATION OF FUZZY
ALGORITHMS, CONTROL OF SIMPLE DYNAMIC PLANT, CONTROLLER
   SECTION CLASS CODES: C7851, C8846
   UNIFIED CLASS CODES: WMKCAD, WMEKAS
   THE PAPER DESCRIBES A SCHEME IN WHICH A FUZZY ALGORITHM IS USED TO
CONTROL PLANT, IN THIS CASE, A LABORATORY-BUILT STEAM ENGINE. THE
ALGORITHM IS IMPLEMENTED AS AN INTERPRETER OF A SET OF RULES EXPRESSED
AS FUZZY CONDITIONAL STATEMENTS. THIS IMPLEMENTATION ON A DIGITAL
COMPUTER IS USED ON-LINE, TO CONTROL THE PLANT. THE MERIT OF SUCH A
CONTROLLER IS DISCUSSED IN THE LIGHT OF THE RESULTS OBTAINED

732554   B7508079
   DIGITAL DWELL ANGLE ENCODER
   SHAKIB, J.   : IBM, NEW YORK, USA
   IBM TECH. DISCLOSURE BULL. (USA)   VOL.27, NO.5   1280-1   OCT. 1974
    CODEN: IBMTAA
   DESCRIPTORS: COUNTING CIRCUITS, ELECTRIC IGNITION
   IDENTIFIERS: DIGITAL DWELL ANGLE ENCODER, DWELL ANGLE, IGNITION
SYSTEM, LOGICALLY GATING CLOCK PULSES, COUNTING CIRCUITS, AUTOMATED
DATA ACQUISITION, DIAGNOSTICS OF AUTOMOBILE ENGINE PERFORMANCE
   SECTION CLASS CODES: B1830, B5620, B1870
   UNIFIED CLASS CODES: ETGAAT, TKEAAR, ETWAAP
   THE DWELL ANGLE OF THE POINTS OF AN IGNITION SYSTEM FOR AN INTERNAL
COMBUSTION ENGINE IS DIGITIZED BY LOGICALLY GATING CLOCK PULSES INTO
COUNTING CIRCUITS. THE APPARATUS IS PARTICULARLY USEFUL FOR PROVIDING
A DIRECT READOUT DIGITAL RESULT OR INPUT DATA TO A COMPUTER, AND IS
PARTICULARLY WELL SUITED FOR AUTOMATED DATA ACQUISITION AND
DIAGNOSTICS OF AUTOMOBILE ENGINE PERFORMANCE

727295   C7505344
   A SIMILARITY PARAMETER FOR SCALING DYNAMIC INLET DISTORTION
   MOORE, M.T.   : GENERAL ELECTRIC CO., CINCINNATI, OHIO, USA
   TRANS. ASME SER. B (USA)   VOL. 96, NO. 3   795-800   AUG. 1974
CODEN: JEFIA8
   DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, AEROSPACE ENGINES
   IDENTIFIERS: METHOD D PARAMETER, SIMILARITY PARAMETER, DYNAMIC INLET
DISTORTION, ANALOGUE AND DIGITAL ANALYSES, METHOD D DISTORTION
METHODOLOGY, ANALOGUE FILTERING, DIGITAL AVERAGING, TURBINE ENGINE
PERFORMANCE
   SECTION CLASS CODES: C8849
   UNIFIED CLASS CODES: WMEZAN
   DESCRIBES THE ANALOGUE FILTER BANDWIDTH AND DIGITAL AVERAGE TIME OF
THE TIME-DEPENDENT PRESSURE DATA PRIOR TO COMPUTATION OF THE METHOD D
PARAMETERS. ANALOGUE FILTERING AND DIGITAL AVERAGING ARE SHOWN TO BE
EQUIVALENT UNDER CERTAIN CONDITIONS AND CONSISTENT SELECTION CAN BE
MADE FOR COMPARISON OF TRENDS IN INLET DYNAMIC DISTORTION BETWEEN
INLETS OF DIFFERENT TYPES AND SIZES

727276   C7505324
PROSPECTS FOR ADVANCED COMPUTER ROLES IN MARINE ENGINE MONITORING
WILLIAMS, V.E.
SPERRY TECHNOL. (USA)   VOL. 2 NO. 2   34-5   1974   CODEN: SPTYBV
DESCRIPTORS: MARINE   SYSTEMS,   NAVAL   ENGINEERING,   ENGINEERING
APPLICATIONS OF COMPUTERS
IDENTIFIERS: ALARM   SCANNING   TECHNIQUE,   DIGITAL   COMPUTER,   DATA
PROCESSING, MARINE ENGINE MONITORING, AUTOMATED SYSTEM, WARNING SYSTEM
, PREDICTIVE MAINTENANCE SYSTEM, PROGRAMMING MATHEMATICAL MODELS,
SAFETY CONTROL SYSTEMS
SECTION CLASS CODES: C8847, C8846, C8849
UNIFIED CLASS CODES: WMFMAD, WMEKAS, WMEZAN
REVIEWS   THE   APPLICATIONS   OF COMPUTERS IN MARINE ENGINE MONITORING
WHICH INCLUDE AUTOMATED SYSTEM, WARNING SYSTEM, PREDICTIVE MAINTENANCE
SYSTEM, PROGRAMMING MATHEMATICAL MODELS, AND SAFETY CONTROL SYSTEMS

726729   P7504833, C7504672
ADJUSTABLE COUNTER FOR THE CONTROL OF A DIESEL ENGINE TEST PROGRAMME
GRYGAS, U., HOTTOWITZ, R.   ; TECH. HOCHSCHULE OTTO VON GUERICKE
MAGDEBURG, GERMANY
WISS. Z. TECH. HOCHSCH. OTTO VON GUERICKE MAGDEB. (GERMANY)   VOL.
18 NO. 3   311-15   1974   CODEN: WCGMAI
DESCRIPTORS: COUNTERS,   COUNTER   ACCESSORIES,   ELECTRIC   CONTROL
EQUIPMENT,   INTERNAL   COMBUSTION   ENGINES,   AUTOMATIC   TEST EQUIPMENT,
MACHINE TESTING
IDENTIFIERS: ADJUSTABLE COUNTER, ANALOGUE TO DIGITAL CONVERTOR,
CONTROL, DIESEL ENGINE, TEST PROGRAMME, TEST BED, TECHNICAL UNIVERSITY
OF MAGDEBURG, FUEL INJECTION, CAMERA FILM TRANSPORT, OSCILLOSCOPE
CAMERA,   COMBUSTION   PRESSURE,   PHOTOELECTRIC   PULSES,   CRANKSHAFT,
CAMSHAFT, LOGIC SYSTEM, MIXTURE FORMATION, COMBUSTION PROCESSES
SECTION CLASS CODES: C7896, C7682, B1269
UNIFIED CLASS CODES: VMZRAY, VKMCAV, ADGMAE
LANGUAGE: GERMAN
DESCRIBES   A   TEST   BED   AT THE TECHNICAL UNIVERSITY OF MAGDEBURG TO
STUDY THE MIXTURE FORMATION AND COMBUSTION PROCESSES ON A ONE-CYLINDER
DIESEL ENGINE. AN ADJUSTABLE COUNTER UNIT CONTROLS THE SWITCHING
INSTANTS OF FUEL INJECTION, CAMERA FILM TRANSPORT, OSCILLOSCOPE CAMERA
AND ANALOGUE-TO-DIGITAL CONVERTER OF COMBUSTION PRESSURE. THE COUNTER
IS GOVERNED BY PHOTO ELECTRIC PULSES FROM THE CRANKSHAFT, CAMSHAFT AND
DEAD CENTRE POSITION. THE COUNTER ACTIVATES THE MEASURING INSTRUMENTS
DURING A PRESCRIBED WORK PERIOD OF THE ENGINE, ENABLING DIRECT
COMPARISON OF DIFFERENT MEASURED QUANTITIES. THE ORGANIZATION OF THE
MEASUREMENT   PROGRAMME   IS   DISCUSSED AND THE LOGIC SYSTEM AND
CONSTRUCTION OF THE COUNTER ARE DESCRIBED

722527   B7506913, C7503292
SMALL TRANSFORMER DESIGN BY COMPUTER
PALMER, M.D.
REPORT NO.: RAE-TR-73155   ISSUED BY: ROYAL AIRCRAFT ESTABL.,
FARNBOROUGH, ENGLAND
FEB. 1974
DESCRIPTORS: POWER TRANSFORMERS, ELECTRICAL ENGINEERING APPLICATIONS
OF COMPUTERS, ION ENGINES, AEROSPACE APPLICATIONS OF COMPUTERS,
COMPUTER-AIDED DESIGN
IDENTIFIERS: POWER TRANSFORMER DESIGN, COMPUTER AIDED DESIGN,
AEROSPACE PROPULSION, ION ENGINE SUPPLY, AEROSPACE APPLICATIONS OF
COMPUTERS, IMPROVEMENTS IN EFFICIENCY, REDUCTION IN MASS
   SECTION CLASS CODES: B4760, B5350, C8849, C8841
   UNIFIED CLASS CODES: ZLKAAM, TGKAAT, WMEZAN, WMECAE
   AVAILABILITY: NTIS, SPRINGFIELD, VA. 22151, USA
   A COMPUTER PROGRAM WAS WRITTEN TO INVESTIGATE TRANSFORMER DESIGN FOR
AN ION MOLAR APPLICATION UNDER CONDITIONS COMPATIBLE WITH THE OTHER
CIRCUIT ELEMENTS WITH THE AIM OF OBTAINING IMPROVEMENTS IN EFFICIENCY
AND REDUCTION IN MASS. TRANSFORMERS PRODUCED FROM THE RESULTING
DESIGNS FEATURED EFFICIENCIES IN EXCESS OF 98PERCENT AND MASSES SOME
25PERCENT LESS THAN THEIR PREDECESSORS

717924   B7503984, C7503268
MEASUREMENT OF INDICATED MEAN EFFECTIVE PRESSURE OF A RECIPROCATING
ENGINE WITH A MINICOMPUTER
SHINOYAMA, E., YANAGIHARA, S.
J. MECH. ENG. LAB. (JAPAN)   VOL.28, NO.1   17-20   JAN. 1974
CODEN: KGKSBL
DESCRIPTORS: INTERNAL COMBUSTION ENGINES, ENGINEERING APPLICATIONS
OF COMPUTERS, PRESSURE MEASUREMENT
IDENTIFIERS: ENGINEERING   APPLICATION   OF   COMPUTERS,   INTERNAL
COMBUSTION ENGINES, MEASUREMENT OF INDICATED MEAN EFFECTIVE PRESSURE,
RECIPROCATING ENGINE, MINICOMPUTER, STROKE SIGNAL GENERATOR, TWO
STROKE GASOLINE ENGINE
   SECTION CLASS CODES: C8847, B4449, C7449
   UNIFIED CLASS CODES: WMFMAD, BKETAR
   LANGUAGE: JAPANESE
   DESCRIBES THE METHOD WHICH HAS BEEN DEVELOPED TO REDUCE THE
INDICATED MEAN EFFECTIVE PRESSURE (I.M.E.P.) OF EACH CYCLE AND A
CONTINUOUS 1000 CYCLES, BY USING A MINICOMPUTER AND STROKE SIGNAL
GENERATOR. THE STROKE IS DIVIDED INTO TWENTY PARTS HAVING THE SAME
VOLUME AND THE REPRESENTATIVE CYLINDER PRESSURE DETECTED BY A
PRECISION PRESSURE PICK-UP IS SAMPLED WITH THE COMPUTER AT THE
MID-POINT OF EACH DIVIDED STROKE. IN THE DIGITAL COMPUTER THE PRESSURE
SIGNALS ARE PROCESSED IN REAL TIME (ON LINE) AND I.M.E.P. AND THE
OTHER VALUES OF EACH CYCLE ARE MEMORIZED. THE METHOD WAS APPLIED TO A
TWO STROKE GASOLINE ENGINE AND THE RESULTS WERE COMPARED WITH ENGINE
DYNAMOMETER TORQUE   (2 REFS)

708959   B7501614, C7501314
PREDICTION OF PRESSURE AND FLOW TRANSIENTS IN A GASEOUS BIPROPELLANT
REACTION CONTROL ROCKET ENGINE
   MARKOWSKY, J.J.   ; AMERICAN ELECTRIC POWER SERVICE CORP., NEW YORK
   COMPUT. AND FLUIDS (GB)   VOL. 2 NO. 2   145-61   AUG. 1974   CODEN:
CFFLBI
   DESCRIPTORS: ROCKETS, COMBUSTION, CONTROL SYSTEMS, COMPUTER-AIDED
ANALYSIS, AEROSPACE APPLICATIONS OF COMPUTERS
   IDENTIFIERS: UPSTREAM WEIGHTED DIFFERENCING SCHEMES, MASS TRANSFER,
PRESSURE TRANSIENTS, $H_2 + O_2$ REACTION, CONTINUITY EQUATIONS,
FLOW TRANSIENTS, GASEOUS BIPROPELLANT REACTION CONTROL ROCKET ENGINE,
VALVES, MANIFOLDS, INJECTORS, FEEDLINE, MANIFOLD VOLUME, IBM 360/65,
COMBUSTION LAG TIME, FORTRAN IV
   SECTION CLASS CODES: B4710, C8849, C7875
   UNIFIED CLASS CODES: ZLCAAJ, WMEZAN, VHRMAY
   AN ANALYTIC MODEL IS DEVELOPED TO PREDICT PRESSURE AND FLOW
TRANSIENTS IN A GASEOUS HYDROGEN-OXYGEN REACTION CONTROL ROCKET ENGINE
FEED SYSTEM. THE ONE-DIMENSIONAL EQUATIONS OF MOMENTUM AND CONTINUITY
ARE REDUCED BY THE METHOD OF CHARACTERISTICS FROM PARTIAL DERIVATIVES
TO A SET OF TOTAL DERIVATIVES WHICH DESCRIBE THE STATE PROPERTIES
ALONG THE FEEDLINE. SYSTEM COMPONENTS, E.G. VALVES, MANIFOLDS AND
INJECTORS ARE REPRESENTED BY PSEUDO STEADY-STATE RELATIONS AT DISCRETE
JUNCTIONS IN THE SYSTEM. SOLUTIONS WERE EFFECTED BY A FORTRAN IV
PROGRAM ON AN IBM 360/65. THE RESULTS INDICATE THE RELATIVE EFFECT OF
MANIFOLD VOLUME, COMBUSTION LAG TIME, FEEDLINE PRESSURE FLUCTUATIONS,
PROPELLANT TEMPERATURE, AND FEEDLINE LENGTH ON THE CHAMBER PRESSURE
TRANSIENT. THE ANALYTICAL COMBUSTION MODEL IS VERIFIED BY GOOD
CORRELATION BETWEEN PREDICTED AND OBSERVED CHAMBER PRESSURE TRANSIENTS
   (15 REFS)

708920   C7501275
   COMPUTER-AIDED DESIGN OF THERMALLY LOADED AXISYMMETRIC DIESEL ENGINE
COMPONENTS
   TOMLINSON, G.R., LEONARD, R., HENSHALL, S.H.   ; MANCHESTER
POLYTECH., ENGLAND
   COMPUT. AIDED DES. (GB)   VOL. 6 NO. 3   132-5   JULY 1974   CODEN:
CAIDA5
   DESCRIPTORS: COMPUTER AIDED DESIGN, FINITE ELEMENT ANALYSIS, STRESS
ANALYSIS, INTERNAL COMBUSTION ENGINES
   IDENTIFIERS: THERMALLY LOADED AXISYMMETRIC DIESEL ENGINE COMPONENTS,
FINITE ELEMENT METHODS, DESIGN, PISTON CROWNS: CYLINDER LINERS,
EXHAUST VALVES, PISTON RING GROOVE DISTORTION, EXHAUST VALVE
TEMPERATURES, LINER STRESSES
   SECTION CLASS CODES: C8847
   UNIFIED CLASS CODES: WHRMAD
   DESCRIBES THE USE OF FINITE ELEMENT METHODS FOR THE DESIGN OF PISTON
CROWNS CYLINDER LINERS AND EXHAUST VALVES AND IT IS SHOWN THAT A
MARKED CORRELATION EXISTS BETWEEN PREDICTED AND MEASURED RESULTS.
HENCE FACTORS SUCH AS PISTON RING GROOVE DISTORTION EXHAUST VALVE
TEMPERATURE AND LINER STRESSES CAN BE REALLY EVALUATED AT REASONABLE
COST   (8 REFS)

701431   C7424923
   DIGITAL SIMULATION OF STATIONARY GAUSSIAN LOADS
   KANEMATSU, H., NASH, W.A.   ; UNIV. MASSACHUSETTS, AMHERST, USA
   ; POLISH ACAD. SCI. ET AL
   ZAGADNIENIA DRGAN NIELINIOWYCH (POLAND)   247-65   1974   CODEN:
ZDWIAD
   CONF: 6TH INTERNATIONAL CONFERENCE ON NONLINEAR OSCILLATIONS   29
AUG. - 4 SEPT. 1972   POLISH ACAD. SCI. ET AL   POZNAN, POLAND
   DESCRIPTORS: RANDOM NUMBER GENERATION, SIMULATION, RANDOM PROCESSES
   IDENTIFIERS: DIGITAL SIMULATION, STATIONARY GAUSSIAN LOADS, FILTERED
WHITE NOISE RANDOM PROCESS, LINEAR FILTER, JET ENGINE SOUND PRESSURES,
BOUNDARY LAYER PRESSURE FLUCTUATIONS, GUST LOADINGS, ATMOSPHERIC
TURBULENCE
   SECTION CLASS CODES: C8890, C8812
   UNIFIED CLASS CODES: WMZAAF, WMCEAA
   LANGUAGE: ENGLISH
   THIS STUDY IS CONCERNED WITH A DIGITAL SIMULATION TECHNIQUE FOR
REPRESENTING A NON-WHITE STATIONARY GAUSSIAN RANDOM PROCESS. A
FILTERED WHITE NOISE RANDOM PROCESS IS OBTAINED BY PASSING AN
APPROXIMATE WHITE NOISE RANDOM PROCESS THROUGH A LINEAR FILTER. AS
APPLICATIONS, JET ENGINE SOUND PRESSURES, BOUNDARY LAYER PRESSURE
FLUCTUATIONS, AND GUST LOADINGS IN ATMOSPHERIC TURBULENCE ARE
SIMULATED BY USING VARIOUS TYPES OF FIRST AND SECOND ORDER LINEAR
FILTERS   (10 REFS)

693717   C7422473
   DIGITAL ENGINE CONTROL SYSTEM FOR FUEL-INJECTION AND IGNITION TIMING
   BREIMESSER, F., KUZNIA, CH.   ; SIEMENS AG MUNCHEN, GERMANY
   ; CONVENTION OF NAT. SOC. ELECTRICAL ENGRS. WESTERN EUROPE, IEEE
   EUROPEAN CONFERENCE ON ELECTROTECHNICS. EUROCON :74 DIGEST.
(EXTENDED ABSTRACTS ONLY)   B5-12/2PP.   1974
   22-26 APRIL 1974   CONVENTION OF NAT. SOC. ELECTRICAL ENGRS. WESTERN
EUROPE, IEEE   AMSTERDAM, NETHERLANDS
   PUBL: ROYAL INSTN. ENGRS., NETHERLANDS   THE HAGUE, NETHERLANDS
   DESCRIPTORS: INTERNAL COMBUSTION ENGINES, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS, AUTOMOBILES, FUEL, IGNITION, DIGITAL
CONTROL, TABLE LOOKUP
   IDENTIFIERS: AUTOMOTIVE APPLICATIONS, DIGITAL COMPUTERIZED SYSTEM,
IGNITION TIMING, TABLE LOOKUP, INTERPOLATION, THROTTLE ANGLE, ENGINE
SPEED, FUEL INJECTION CONTROL
   SECTION CLASS CODES: C7851, C8846, C8440, C7871
   UNIFIED CLASS CODES: WMKCAD, WMEKAS, WGEAAJ, WMRCAZ
   A DIGITAL COMPUTERIZED SYSTEM FOR THE ACCURATE CONTROL OF THE
FUEL-TO-AIR RATIO AND THE IGNITION TIMING HAS BEEN DEVELOPED.
EXPERIMENTS SHOWED A CONSIDERABLE REDUCTION OF EXHAUST EMISSIONS AND
FUEL CONSUMPTION. TO GENERATE THE CONTROL SIGNALS, A TABLE LOOKUP
TECHNIQUE WITH INTERPOLATION IS USED. THE TWO PARAMETERS WHICH DEFINE
THE OPERATING CONDITION OF THE ENGINE, NAMELY THE THROTTLE ANGLE AND
THE ENGINE SPEED, ARE USED FOR TABLE ENTRANCE

683813   B7435293, C7421849
RB199 RELATED SUB-SYSTEMS AND ASSOCIATED COMPONENTS
AIRCR. ENG. (GB)   VOL.46, NO.5   9-10, 13-16   MAY 1974   CODEN:
AIENAP
DESCRIPTORS: AEROSPACE PROPULSION, AEROSPACE ENGINES, AIRCRAFT,
CLOSED LOOP SYSTEMS, AEROSPACE CONTROL, AEROSPACE APPLICATIONS OF
COMPUTERS, HEAT EXCHANGERS, AEROSPACE INSTRUMENTATION, CONTROL
ENGINEERING APPLICATIONS OF COMPUTERS
IDENTIFIERS: MRCA, RB199 ENGINE, DIGITAL AIR INTAKE CONTROLLER, FUEL
COOLED OIL COOLER, AIR COOLED FUEL COOLER, FUEL SYSTEM PRESSURE
REDUCING VALVES, HIGH ENERGY IGNITION UNIT, TURBINE BLADE PYROMETER
AMPLIFIER, NORD-MICRO GMBH, HAWKER SIDDELEY DYNAMICS, MAGNETI MARELLI,
AIR INTAKE ANTI/DEICING SYSTEM, INTEGRATED PUMP AND CONTROL SYSTEM,
AUXILIARY POWER UNIT, GEARBOX CONTROL UNIT, PRECOOLER OUTLET
TEMPERATURE CONTROL, WATER EXTRACTOR, VARIABLE GEOMETRY AIR INDUCTION,
AERODYNAMICALLY CLOSED LOOP
   SECTION CLASS CODES: B4740, C8846, C8849, C7875
   UNIFIED CLASS CODES: ZLGAAP, WHEKAS, WHEZAN, VHRMAY
   DESCRIBES FEATURES OF THE MRCA RELATED TO THE RB199 ENGINE,
INCLUDING: DIGITAL AIR INTAKE CONTROLLER, AIR INTAKE ANTI-ICE SYSTEM,
FUEL COOLED OIL COOLER, AIR COOLED FUEL COOLER, FUEL SYSTEM PRESSURE
REDUCING VALVES, HIGH ENERGY IGNITION UNIT AND THE TURBINE BLADE
PYROMETER AMPLIFIER. FIRMS PARTICIPATING IN THESE DEVELOPMENTS INCLUDE
NORD-MICRO GMBH, HAWKER SIDDELEY DYNAMICS AND MAGNETI MARELLI

674355   C7419467
   AN EXPERIMENTAL INVESTIGATION INTO DUPLEX DIGITAL CONTROL OF AN
ENGINE WITH REHEAT
   EVANS, J.F.O., HELPS, K.A.
   ; AGARD
   AGARD CONFERENCE PROCEEDINGS NO. 137 ON ADVANCES IN CONTROL SYSTEMS
16/1-14   1974
   24-26 SEPT. 1973   AGARD   GEILO, NORWAY
   PUBL: AGARD   NEUILLY SUR SEINE
   DESCRIPTORS: AEROSPACE ENGINES, AEROSPACE CONTROL, DIRECT DIGITAL
CONTROL, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS, AEROSPACE
APPLICATIONS OF COMPUTERS
   IDENTIFIERS: DUPLEX DIGITAL CONTROL, ENGINE WITH REHEAT, CROSS
MONITORING COMPUTERS, HYDROMECHANICAL BACK UP SYSTEM
   SECTION CLASS CODES: C7875, C8846, C8849
   UNIFIED CLASS CODES: VHRMAY, WHEKAS, WHEZAN
   DESCRIBES AN EXPERIMENTAL INVESTIGATION INVOLVING THE CONTROL OF A
P.S. 50 ENGINE BY A PAIR OF CROSS-MONITORING COMPUTERS WITH A
HYDROMECHANICAL BACK-UP SYSTEM. THE CONTROLLER WAS DEVELOPED JOINTLY
BY SMITHS INDUSTRIES LIMITED, AND DOWTY FUEL SYSTEMS LIMITED, AND WAS
COMMISSIONED AND RUN IN LATE 1972 AT THE D.F.S. TEST BED AT STAVERTON,
ENGLAND. THE P.S. 50 IS A SINGLE SPOOL ENGINE WITH MULTI-MANIFOLD
REHEAT

662848   B7427801, C7416947
  A :SPEEDY: APPROACH TO DIGITAL FREQUENCY METERING
  CREASEY, D.
  ELECTRON. EQUIP. NEWS (GB)   VOL.15, NO.11   64-5   APRIL-MAY
19.TEGE TRS A O OLL7 O   CODEN: EEQNAW
  DESCRIPTORS: FREQUENCY METERS, INTERNAL COMBUSTION ENGINES, GAS
TURBINES, TACHOMETERS, DIGITAL INSTRUMENTATION
  IDENTIFIERS: INTERNAL COMBUSTION ENGINES, AIRCRAFT TURBINE ENGINES,
PERFORMANCE ADJUSTMENT, GAS TURBINE ENGINES, ENGINE DEVELOPMENT,
DIGITAL FREQUENCY METERING
  SECTION CLASS CODES: B4424, B4442, B5240, B4270, C7660
  UNIFIED CLASS CODES: BKCKAZ, BKEEAM, TEGAAX, BECRAX
  DISCUSSES APPLICATION TO INTERNAL COMBUSTION ENGINES AND AIRCRAFT
TURBINE ENGINES FOR PERFORMANCE ADJUSTMENT

641129   A7439135, C7412723
  NOISE MEASUREMENT ON A V-6 DIESEL ENGINE
  CHUNG, J.Y., CROCKER, M.J., HAMILTON, J.F.   ; PURDUE UNIV., WEST
LAFAYETTE, IND., USA
  TREE, D.R.
  ; INST. NOISE CONTROL ENGNG
  1973 NATIONAL CONFERENCE ON NOISE CONTROL ENGINEERING   86-91   1973
15-17 OCT. 1973   INST. NOISE CONTROL ENGNG   WASHINGTON, D.C., USA
  PUBL: INST. NOISE CONTROL ENGNG.   POUGHKEEPSIE, N.Y., USA
  DESCRIPTORS: NOISE ABATEMENT, ACOUSTIC NOISE, INTERNAL COMBUSTION
ENGINES, FOURIER ANALYSIS, ACOUSTIC INTENSITY MEASUREMENT
  IDENTIFIERS: NOISE SPECTRA, DIGITAL FOURIER ANALYSER, STRUCTURAL
ATTENUATION, DIESEL ENGINE NOISE, VEE 6 DIESEL ENGINE
  SECTION CLASS CODES: A9890, C7455
  UNIFIED CLASS CODES: ZCZAEZ, VGEZAP
  THE MEASUREMENTS OF THE NOISE SPECTRA WHICH ARE SHOWN IN THIS PAPER
HAVE BEEN MADE BY MEANS OF A DIGITAL FOURIER ANALYSER. THE MAIN
PURPOSE OF THE PAPER IS TO DISCUSS THE STRUCTURAL ATTENUATION OF THE
DIESEL ENGINE NOISE

618181　B7412495, C7408932
BEAM DIAGNOSTICS OF THE RIT 10-ENGINE
ALTENBURG, W., GRISEL, J.　; GIESSEN UNIV., GERMANY
; IEE, UKAEA
STD BOOK NO.: 0 85296119 7
CONFERENCE ON ELECTRIC PROPULSION OF SPACE VEHICLES　48-52　1973
10-12 APRIL 1973　IEE, UKAEA　ABINGDON, BERKS., ENGLAND
PUBL: IEE　LONDON, ENGLAND
DESCRIPTORS:　ION　ENGINES,　ION　BEAMS,　AEROSPACE　ENGINES,
COMPUTER-AIDED　ANALYSIS,　AEROSPACE　APPLICATIONS　OF COMPUTERS, DATA
REDUCTION AND ANALYSIS, ELECTRIC PROPULSION
IDENTIFIERS: RIT 10 ENGINE, ION THRUSTERS, BEAM DIAGNOSTICS, ANGULAR
DISTRIBUTION,　ENERGY,　CHARGE SPECTRUM, DIVERGENCE EFFICIENCY, THRUST
VECTOR DEVIATION, INTEGRATED BEAM CURRENT
SECTION CLASS CODES: B4760, C8849
UNIFIED CLASS CODES: ZLKAAM, WMEZAN
TO　DETERMINE　THE　BEAM DATA OF RIT 10- THRUSTERS, E.G. THE ANGULAR
DISTRIBUTION,　ENERGY　CHARGE　SPECTRUM, THE DIVERGENCE EFFICIENCY, AN
EVENTUAL　THRUST　VECTOR　DEVIATION　AS　WELL　AS　THE INTEGRATED BEAM
CURRENT,　A SPECIAL BEAM DIAGNOSTIC APPARATUS HAS BEEN BUILT UP IN THE
PUMPING FACILITY :P 6000:. BY USING DIFFERENT MOVABLE PROBES WHICH ARE
DRIVEN　BY　THREE　ELECTRIC MOTORS, THE BEAM REGION UP TO 1 M DISTANCE
FROM THE THRUSTER EXIT CAN BE SCANNED CONTINUOUSLY. THE DATA PICKED UP
BY　THE　PROBE　(ABOUT　30000　FOR　EACH PROFILE) ARE FED TO A DIGITAL
COMPUTER　(HONEYWELL　H　316) WHICH PLOTS THE PROFILE CARDS AND PRINTS
THE　ABOVE　MENTIONED PERFORMANCE DATA. FIRST EXPERIMENTAL RESULTS ARE
GIVEN　(4 REFS)

618174　C7408925
ENGINE DATA LOGGED FASTER BY COMPUTER
SYSTEMS (GB)　VOL.1, NO.2　22-3　OCT. 1973
DESCRIPTORS:　INTERNAL　COMBUSTION　ENGINES,　DATA ACQUISITION,
ENGINEERING APPLICATIONS OF COMPUTERS
IDENTIFIERS:　INTERNAL　COMBUSTION　ENGINE,　PERFORMANCE,　DATA
ACQUISITION SYSTEM, COMPUTER
SECTION CLASS CODES: C8849
UNIFIED CLASS CODES: WMEZAN
THE　NEED　FOR　AUTOMATION　IN MONITORING INTERNAL COMBUSTION ENGINE
PERFORMANCE　HAS　BEEN　RECOGNISED BY MANY ORGANISATIONS INCLUDING THE
SOUTHWEST　RESEARCH　INSTITUTE,　TEXAS,　WHERE　PROJECTS INVOLVE THE
EVALUATION　OF DIESEL AND PETROL ENGINES FOR FUEL ECONOMY, LUBRICATION
PERFORMANCE,　OCTANE　REQUIREMENTS, HYDROCARBON EMISSION ETC. RECENTLY
THE　SNGLE-CYLINDER　CATERPILLAR ENGINE LABORATORY THAT CAN MONITOR 50
ENGINES　SIMULTANEOUSLY　HAS　BEEN　AUTOMATED　WITH　A HEWLETT-PACKARD
SENSOR-BASED DATA ACQUISITION SYSTEM

606088   B7405160, C7406042
  A COMPUTER-CONTROLLED ENGINE TEST CELL FOR ENGINEERING EXPERIMENTS
  RILLINGS, J.H., CREPS, W.D., VORA, L.S.   ; GENERAL MOTORS RES.
LABS., WARREN, MICH., USA
  PROC. IEEE (USA)   VOL.61, NO.11   1622-6   NOV. 1973   CODEN:
IEEPAD
  DESCRIPTORS: AUTOMATIC   TEST   EQUIPMENT,   AUTOMOBILES,   INTERNAL
COMBUSTION   ENGINES,   CONTROL   ENGINEERING   APPLICATIONS OF COMPUTERS,
ENGINEERING   APPLICATIONS   OF   COMPUTERS,   DATA   ACQUISITION,   DATA
REDUCTION AND ANALYSIS, COMPUTER-AIDED ANALYSIS
  IDENTIFIERS: AUTOMOTIVE   ENGINES,   DATA   ACQUISITION,   COMPUTER
CONTROLLED ENGINE TEST CELL
  SECTION CLASS CODES: B1269, C8849, C7851
  UNIFIED CLASS CODES: ADGMAR, WMEZAN, VMKCAD

  A COMPUTER-CONTROLLED ENGINE TEST CELL WAS DEVELOPED FOR CONDUCTING
COMPLEX TRANSIENT EXPERIMENTS WITH AUTOMOTIVE ENGINES. THE TEST CELL
USES A MINICOMPUTER WITH A 16000-WORD 16-B CORE MEMORY TO PERFORM DATA
ACQUISITION AND CLOSED-LOOP CONTROL OF THE ENGINE AND DYNAMOMETER. A
TABLE-DRIVEN   REAL-TIME   CONTROL   PROGRAM   IS   USED   TO   DUPLICATE THE
EFFECTS OF VEHICLE, TRANSMISSION, AND ROAD ON ENGINE OPERATION.
REFERENCE DATA AND ACQUIRED DATA ARE EXCHANGED OVER A HIGH-SPEED
COMMUNICATIONS CHANNEL BETWEEN THE MINICOMPUTER AND A CENTRALIZED DATA
ACQUISITION COMPUTER (DAC) SYSTEM. DATA CAN BE PLOTTED AGAINST TIME OR
CROSS-PLOTTED AGAINST OTHER PARAMETERS ON A GRAPHIC CATHODE-RAY-TUBE
DISPLAY PERIPHERAL TO THE MINICOMPUTER. THE USER CAN INTERACT WITH THE
SYSTEM TO CHANGE PARAMETERS DURING THE RUNNING OF AN EXPERIMENT   (2
REFS)

585989.   C7401117
   SOLUTION IMPROVEMENT IN COMPUTERIZED STRUCTURAL ANALYSIS SIMULATION
   PITTS, G.N., BATEMAN, R.   ; CENTRAL TEXAS COLL., KILLEEN, USA
   ; ISA, ET AL
   STD BOOK NO.: I
   PROCEEDINGS OF THE 1973 SUMMER COMPUTATION SIMULATION CONFERENCE
476-8 1973
   13-19 JULY 1973 ISA, ET AL MONTREAL, QUEBEC, CANADA
   PUBL: SIMULATION COUNCIL LA JOLLA, CALIF., USA
   DESCRIPTORS: AEROSPACE SIMULATION, AEROSPACE APPLICATIONS OF
COMPUTERS, AEROSPACE ENGINES, COMPUTER AIDED ANALYSIS, NUMERICAL
ANALYSIS
   IDENTIFIERS: STRUCTURAL ANALYSIS, SIMULATION, AIRCRAFT, ROCKET,
ENGINE
   SECTION CLASS CODES: C8849, C8200
   UNIFIED CLASS CODES: WMEZAN, DLTAAE
   WITH THE STATE OF THE ART IN AIRCRAFT AND ROCKET ENGINE DESIGN
REACHING AN UNPRECEDENTED HEIGHT, STRUCTURAL ANALYSIS HAS BECOME AN
EXTREMELY DIFFICULT TASK. THE ENGINEER IS FACED WITH THE COMPLEX
PROBLEM OF AN ENGINE OPERATING AT VERY HIGH TEMPERATURE WITH
EXCEPTIONALLY LARGE STRESSES AND STRAINS. SINCE MANY STRUCTURAL
PROBLEMS CAN BE SIMULATED WITH SYSTEMS OF NONLINEAR SIMULTANEOUS
EQUATIONS, MUCH TIME AND EFFORT HAS BEEN SPENT ON DEVELOPING VARIOUS
METHODS TO SOLVE THESE SYSTEMS. THE SOLUTION METHOD PRESENTED IN THIS
PAPER IS A COMBINATION AND MODIFICATION OF METHODS WHICH RESULTS IN A
SIGNIFICANT DECREASE IN SOLUTION COST AND EXECUTION TIME. THE PROPOSED
METHOD IS CHARACTERIZED BY RAPID CONVERGENCE AND LESS CRITICAL INITIAL
APPROXIMATIONS   (4 REFS)

585971   C7401103
   SIMULATION OF THERMODYNAMIC PROCESS OF A DIESEL ENGINE ON A SMALL
DIGITAL COMPUTER
   OJHA, V.P.   ; DIESEL LOCOMOTIVE WORKS, VARANASI, INDIA
   J. INST. ENG. (INDIA) MECH. ENG. DIV. VOL.53, PT.ME6   292-301
JULY 1973   CODEN: JEMDAS
   DESCRIPTORS: INTERNAL COMBUSTION ENGINES, SIMULATION, THERMODYNAMICS
, MODELLING, ENGINEERING APPLICATIONS OF COMPUTERS
   IDENTIFIERS: SIMULATION, THERMODYNAMIC PROCESS, DIESEL ENGINE, SMALL
DIGITAL COMPUTER, MATHEMATICAL MODEL
   SECTION CLASS CODES: C8849
   UNIFIED CLASS CODES: WMEZAN
   THIS PAPER DISCUSSES A MATHEMATICAL MODEL FOR SIMULATING THE
THERMODYNAMIC PROCESS OF A DIESEL ENGINE. THE MODEL HAS BEEN USED TO
PREDICT THE PERFORMANCE OF 251B, 16 CYLINDER DIESEL ENGINES BEING
MANUFACTURED AT THE DIESEL LOCOMOTIVE WORKS VARANASI. SOME OF THE
CHARACTERISTICS LIKE HEAT RELEASE PATTERN, HEAT TRANSFER COEFFICIENTS
AND EFFICIENCIES OF TURBO COMPONENTS WERE EITHER ASSUMED OR OBTAINED
FROM THE TEST BED RESULTS. THE EFFICACY OF THIS MODEL IS ILLUSTRATED
BY PREDICTING THE PERFORMANCE OF THE SAME ENGINE WORKING AT A
DIFFERENT SPEED AND RATING. THIS MODEL IS COMPACT, WHICH ENABLES IT TO
BE COMPUTERISED FOR SMALL COMPUTERS LIKE THE 140 VERSION OF IBM SERIES
OF DATA PROCESSING MACHINES WITH A STORAGE CAPACITY OF 12K   (11 REFS)

573749　C7323548
THE USE OF A HYBRID COMPUTER IN THE OPTIMIZATION OF GAS TURBINE CONTROL PARAMETERS
SARAVANAMUTTOO, H.I.H., MACISAAC, B.D.　; CARLETON UNIV., OTTAWA, CANADA
TRANS. ASME SER. A (USA)　　VOL.95, NO.3　257-64　JULY 1973
CODEN: JEPOA8
DESCRIPTORS:　HYBRID　COMPUTER　METHODS,　CONTROL　ENGINEERING APPLICATIONS OF COMPUTERS, GAS TURBINES, OPTIMISATION, SIMULATION, AUTOMATIC CONTROL
IDENTIFIERS: SINGLE SPOOL, TURBOJET ENGINE, AUTOMATIC CONTROL, HYBRID　COMPUTER,　OPTIMIZATION,　GAS　TURBINE,　CONTROL　PARAMETERS, SIMULATION, THRUST RESPONSE, ENGINE DYNAMICS
SECTION CLASS CODES: C7851, C8846, C8849
UNIFIED CLASS CODES: WHKCAD, WHKKAS, WHKZAW
THE PAPER DISCUSSES THE HYBRID COMPUTER SIMULATION OF A SINGLE-SPOOL TURBOJET　ENGINE.　THE　PROBLEM　IS　APPROACHED　FROM THE VIEWPOINT OF ENGINEERING　THERMODYNAMICS,　USING　THE NORMAL COMPRESSOR AND TURBINE CHARACTERISTICS.　THIS　WAS　FOUND　TO　YIELD　AN　EXTREMELY　FLEXIBLE SIMULATION　CAPABLE　OF　OPERATION　OVER THE ENTIRE RUNNING RANGE. THE SIMULATION　WAS　USED　TO　INVESTIGATE METHODS OF IMPROVING THE THRUST RESPONSE　AND　IT　WAS　FOUND　THAT A DETAILED INSIGHT INTO THE ENGINE DYNAMICS　PERMITTED　A SIGNIFICANT IMPROVEMENT IN THRUST RESPONSE　(6 REFS)

564358　C7322595
PROCESSING ENGINE TEST DATA USING SPEED
WARMAN, E.A., SCOTT, S.W.
; IEE, ET AL
STD BOOK NO.: 0 85296114 6
CONFERENCE　ON　THE　USE　OF DIGITAL COMPUTERS IN MEASUREMENT　94-8 1973
24-27 SEPT. 1973　IEE, ET AL　YORK, ENGLAND
PUBL: IEE　LONDON, ENGLAND
DESCRIPTORS: INTERNAL COMBUSTION ENGINES, ENGINEERING APPLICATIONS OF COMPUTERS, MACHINE TESTING, COMPUTER AIDED ANALYSIS
IDENTIFIERS: PROCESSING, ENGINE, TEST DATA, SPEED, COMPUTERS
SECTION CLASS CODES: C8849
UNIFIED CLASS CODES: WHEZAW
SPEED:　A SYSTEM FOR PROCESSING EXPERIMENTAL ENGINE DATA IS A SYSTEM OF　HARDWARE　AND　SOFTWARE BEING DEVELOPED BASICALLY FOR THE OFF LINE PROCESSING　OF　MEASUREMENT　DATA　FROM　ENGINES.　THE AIM HAS BEEN TO CREATE　FLEXIBILITY OF USE. A BUILDING BLOCK CONSTRUCTION OF EQUIPMENT HAS BEEN EMPLOYED. TO DATE THE EQUIPMENT HAS RESOLVED INTO A PERMANENT INSTALLATION IN THE NOISE FACILITY: AND A PORTABLE SYSTEM　(2 REFS)

555037   B7333727, C7320776
GUIDELINES IN DESIGNING A DIGITAL DATA ACQUISITION SYSTEM
WESTWICK, J.R.   : GENERAL MOTORS CORP., INDIANAPOLIS, IND., USA
ROBERTS, R.R.
: ISA
STD BOOK NO.: 87664 182 6
PROCEEDINGS OF THE 18TH INTERNATIONAL ISA AEROSPACE INSTRUMENTATION
SYMPOSIUM, VOL.18   29-35   1972
15-17 MAY 1972   ISA   MIAMI, FLA., USA
PUBL: ISA   PITTSBURGH, PA., USA
DESCRIPTORS: DATA   ACQUISITION,   GAS   TURBINES,   AEROSPACE   TEST
FACILITIES, REAL-TIME SYSTEMS, ENGINEERING APPLICATIONS OF COMPUTERS
IDENTIFIERS: DESIGN, SOLID STATE HIGH SPEED COMPUTER HARDWARE,
AEROSPACE,   INDUSTRIAL,   GAS   TURBINE   ENGINE DEVELOPMENT, HIGH SPEED,
TRANSIENT CONDITIONS, GRAPHIC OUTPUT, REAL TIME OPERATION, DIGITAL
DATA ACQUISITION SYSTEM
SECTION CLASS CODES: C8849, B4720, B5244
UNIFIED CLASS CODES: WHEZAW, ZLEAAZ, TEGEAT
DIGITAL DATA ACQUISITION SYSTEM DEVELOPMENT AND DESIGN HAS BECOME
MORE SOPHISTICATED WITH THE AVAILABILITY OF SOLID STATE HIGH SPEED
COMPUTER   HARDWARE   AND   :REAL-TIME: MONITOR   SOFTWARE.   THE   NEWLY
INSTALLED SYSTEM AT DETROIT DIESEL ALLISON SUPPORTS AEROSPACE AND
INDUSTRIAL GAS TURBINE ENGINE DEVELOPMENT TEST PROGRAMS BY PROVIDING
HIGH   SPEED   ACQUISITION OF DATA, DISPLAY OF REAL- TIME PERFORMANCE TO
THE TEST ENGINEER USING THE ACQUIRED DATA, AND QUICK RETURN OF FINAL
PERFORMANCE RESULTS IN GRAPHIC AND TABULAR FORM. THE SYSTEM IS USED
ALSO TO RECORD TRANSIENT CONDITIONS OF PERFORMANCE AND PROVIDE GRAPHIC
OUTPUT OF THESE CONDITIONS FOR ANALYSIS

555002   B7333730, C7320740
DEVELOPMENT OF A DIGITAL CONTROL SYSTEM FOR A SPACECRAFT PROPULSION
TEST FACILITY
    SMALLEY, R.R.   ; NASA, PLUM BROOK STATION, SANDUSKY, OHIO, USA
    ROBERTS, R.R.
    ; ISA
    STD BOOK NO.: 87664 182 6
    PROCEEDINGS OF THE 18TH INTERNATIONAL ISA AEROSPACE INSTRUMENTATION
SYMPOSIUM, VOL.18   69-72   1972
    15-17 MAY 1972   ISA   MIAMI, FLA., USA
    PUBL: ISA   PITTSBURGH, PA., USA
    DESCRIPTORS: AEROSPACE   PROPULSION,   AEROSPACE TEST FACILITIES,
CONTROL SYSTEMS, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS
    IDENTIFIERS: CONTROL SYSTEM, SPACECRAFT PROPULSION TEST FACILITY,
DIGITAL   COMPUTER CONTROL, ABORT SYSTEM, ROCKET ENGINE TESTING,
STRUCTURE TESTING, WIND TUNNEL TESTS, CONTROL FUNCTION UPDATING,
CONTINUOUS ABORT MONITORING, SOFTWARE, SHORT DURATION TESTS, HARDWARE
    SECTION CLASS CODES: B4720, C8846, C7875
    UNIFIED CLASS CODES: ZLEAAZ, WMEKAS, VHRMAY
    A DIGITAL COMPUTER CONTROL AND ABORT SYSTEM WHICH IS USED AT
NASA-LEWIS RESEARCH CENTER:S PLUM BROOK TEST FACILITIES IS DESCRIBED.
THE SYSTEM WAS DESIGNED BY NASA PERSONNEL TO CONTROL TEST OPERATIONS
SUCH AS ROCKET ENGINE TESTING, STRUCTURE TESTING, AND WIND TUNNEL
TESTS.   BECAUSE   OF   THE   NATURE   OF SPACECRAFT SYSTEM TESTING,
PARTICULARLY ROCKET ENGINE TESTING, THE UNIQUE FEATURES OF THE SYSTEM
ARE, CONTROL FUNCTION UPDATING AT A 20 MILLISECOND RATE, CONTINUOUS
ABORT MONITORING AND A SOFTWARE SYSTEM DESIGNED FOR SHORT DURATION
TESTS RATHER THAN CONTINUOUS ON-LINE CONTROL. TO ACCOMPLISH THESE
SYSTEM REQUIREMENTS, SPECIAL HARDWARE WAS DESIGNED

555001   B7333728, C7320739
  SUPERVISORY COMPUTER CONTROL OF JET ENGINE DUAL COMPRESSOR TESTS
  GOODWIN, W., SELLECK, F.G., WATERMAN, A.   ; UNITED AIRCRAFT CORP.,
EAST HARTFORD, CONN., USA
  ROBERTS, R.R.
  ; ISA
  STD BOOK NO.: 87664 182 6
  PROCEEDINGS OF THE 18TH INTERNATIONAL ISA AEROSPACE INSTRUMENTATION
SYMPOSIUM, VOL.18   37-47   1972
  15-17 MAY 1972   ISA   MIAMI, FLA., USA
  PUBL: ISA   PITTSBURGH, PA., USA
  DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, AEROSPACE TEST
FACILITIES, AEROSPACE ENGINES, CONTROL ENGINEERING APPLICATIONS OF
COMPUTERS, CONTROL SYSTEMS, COMPRESSORS
  IDENTIFIERS: SUPERVISORY COMPUTER CONTROL, JET ENGINE DUAL
COMPRESSOR, DIGITAL COMPUTER CONTROLLED, TESTING, COAXIAL GAS TURBINE,
OPERATING PARAMETERS, AERODYNAMIC CONDITIONS, RELIABILITY, FLEXIBILITY
, SYSTEM DESIGN
  SECTION CLASS CODES: B4720, C8846, C7851
  UNIFIED CLASS CODES: ZLEAAZ, WMEKAS, VMKCAD
  DIGITAL COMPUTER CONTROLLED TESTING OF SEPARATELY DRIVEN COAXIAL GAS
TURBINE LOW PRESSURE AND HIGH PRESSURE COMPRESSORS, REFERRED TO AS
:DUAL COMPRESSOR TESTING,: HAS BEEN IMPLEMENTED SUCCESSFULLY. THE
SUPERVISORY CONTROL SYSTEM MEASURES, COMPUTES, AND CONTROLS DUAL
COMPRESSOR OPERATING PARAMETERS, MAINTAINING DESIRED AERODYAMIC
CONDITIONS DURING TESTS. THIS ACHIEVED BY COMPUTER CONTROL OF TWO GAS
TURBINE DRIVE ENGINES OF 18000 HP AND 35000 HP, AND SIX FAST-ACTING
CONTROL VALVES, RANGING UP TO SIX FEET IN DIAMETER. RELIABILITY AND
FLEXIBILITY WERE EMPHASIZED IN THE SYSTEM DESIGN

546160   C7318686
  AN ENGINE TEST LANGUAGE FOR COMPUTER CONTROL OF ENGINE TESTS
  WARMAN, E.A.
  ; IEE, ET AL
  STD BOOK NO.: 0 85296111 1
  CONFERENCE ON SOFTWARE FOR CONTROL   137-44   1973
  17-19 JULY 1973   IEE, ET AL   WARWICK, ENGLAND
  PUBL: IEE   LONDON, ENGLAND
  DESCRIPTORS: AUTOMATIC TESTING, HEAT ENGINES, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS, PROBLEM-ORIENTED LANGUAGES
  IDENTIFIERS: ENGINE TEST LANGUAGE, COMPUTER CONTROL, ENGINE TESTS,
GET L
  SECTION CLASS CODES: C8314, C7851, C8846
  UNIFIED CLASS CODES: WECEAR, VMKCAD, WMEKAS
  A RESEARCH INVESTIGATION INTO THE POSSIBLE LEVELS OF AUTOMATION AND
COMPUTER INVOLVEMENT IN ENGINE TESTING INDICATED IT WOULD BE DESIRABLE
TO DEVELOP A PROGRAMMING LANGUAGE FOR DESCRIBING ENGINE TESTING
SEQUENCES. WORK SUBSEQUENT TO THIS INVESTIGATION IS NOW CONCERNED WITH
EXPANDING THIS LANGUAGE TO ALLOW IT TO DEAL WITH ANY PROCESS
SEQUENCING SITUATION   (5 REFS)

526710   C7315029
THE SCIENTIFIC AND TECHNOLOGICAL INFORMATION SYSTEM OF THE KARL
LIEBKNECHT WORKS AT MAGDEBURG
KARSTEN, E.   ; VEB SCHWERMASCHINENBAU :KARL LIEBKNECHT:, MAGDEBURG,
GERMANY
INFORMATIK (GERMANY)   VOL.20, NO.1   12-14   1973   CODEN: IIDWAN
DESCRIPTORS: INFORMATION DISSEMINATION, INFORMATION CENTRES,
INFORMATION USE, INFORMATION RETRIEVAL SYSTEMS, MINICOMPUTERS
IDENTIFIERS: SCIENTIFIC AND TECHNOLOGICAL INFORMATION SYSTEM, EAST
GERMAN DEMOCRATIC REPUBLIC, INFORMATION CENTRE, MINI COMPUTER, DATA
BANK, DIESEL ENGINE CHARACTERISTICS, INFORMATION DISSEMINATION
   SECTION CLASS CODES: C8580, C8520
   UNIFIED CLASS CODES: ZTRAAR, ZTEAAH
   LANGUAGE: GERMAN
   THIS FACTORY IN THE EAST GERMAN DEMOCRATIC REPUBLIC PRODUCES DIESEL
ENGINES AND OTHER HEAVY INDUSTRIAL EQUIPMENT, ALSO FOR THE PETROLEUM
INDUSTRY. THE INFORMATION CENTRE AT THE WORKS USES A MINI COMPUTER FOR
BUILDING UP A DATA BANK OF DIESEL ENGINE CHARACTERISTICS. VARIOUS
PUBLICATIONS DISSEMINATE USEFUL INFORMATION (ON DIESEL ENGINES AND
RELATED SUBJECTS) TO WIDER CIRCLES. THE CENTRE COOPERATES WITH ITS
POLISH AND RUSSIAN COUNTERPARTS AND FORMS A CONSTITUENT PART OF THE
STATE-CONTROLLED SCIENTIFIC AND TECHNOLOGICAL INFORMATION SYSTEM OF
THE EAST GERMAN REPUBLIC

525758   C7313966
   COLLOQUIUM DIGEST ON COMPUTER STRUCTURES FOR ARTIFICIAL INTELLIGENCE
   ; IEE, IERE
   1973
   11 MAY 1973   IEE, IERE   LONDON, ENGLAND
   PUBL: IEE   LONDON, ENGLAND
   DESCRIPTORS: ARTIFICIAL INTELLIGENCE, BOILERS, COMPUTER APPLICATIONS
, CONTROLLERS, LEARNING SYSTEMS
   IDENTIFIERS: COMPUTER   STRUCTURES,   ARTIFICIAL INTELLIGENCE,
COMPUTATIONAL PROBLEMS, LEARNING NETS, MINERVA AND ASTRA LEARNING
SYSTEMS, OBJECT MOTION SIMULATION, HUMAN CONTROLLERS, ADAPTIVE
CONTROLLERS, STEAM ENGINE BOILER SYSTEM, NEURON PLASTIC CHANGE MODELS
   SECTION CLASS CODES: C6440, C8890
   UNIFIED CLASS CODES: VCKAAR, WMZAAP
   THE FOLLOWING TOPICS WERE DEALT WITH: HUMAN AND AUTOMATIC ADAPTIVE
CONTROLLERS, COMPUTATIONAL PROBLEMS, DYNAMIC DIGITAL LEARNING NETS,
MINERVA AND ASTRA LEARNING SYSTEMS, ITERATIVE ARRAYS FOR OBJECT MOTION
SIMULATION, MODELS OF PLASTIC CHANGE IN NEURONS, AND APPLICATIONS TO
STEAM ENGINE-BOILER SYSTEM. 9 PAPERS WERE PRESENTED, OF WHICH ALL ARE
PUBLISHED IN FULL IN THE PRESENT PROCEEDINGS

518935   C7312556
  ELECTRONIC FUEL INJECTION SYSTEM
  GORDON, C.C., MCGAVIC, J.P.
  PATENT NO.: USA   3702601   ASSIGNERS: GENERAL MOTORS CORP.   FILED:
11 JUNE 1971
  ORIGINAL PATENT APPL. NO.: USA   152088
  14 NOV. 1972
  DESCRIPTORS: INTERNAL COMBUSTION ENGINES, DIGITAL CONTROL, FLOW
CONTROL
  IDENTIFIERS: ELECTRONIC FUEL INJECTION SYSTEM, INTERNAL COMBUSTION
ENGINE, FUEL INJECTORS, TIMING SIGNALS, SYNCHRONIZATION, MAGNITUDE
PERMUTATIONS, PULSE TRAIN, CONTROL PULSES, ENGINE CYCLE
  SECTION CLASS CODES: C7851, C7453
  UNIFIED CLASS CODES: VMKCAD, VGEVAS

  AN INTERNAL COMBUSTION ENGINE INCLUDES A GROUP OF EIGHT FUEL
INJECTORS FOR APPLYING FUEL TO THE ENGINE. A SET OF FOUR TIMING
SIGNALS DEVELOPED IN SYNCHRONIZATION WITH ENGINE OPERATION
COLLECTIVELY CONTAIN EIGHT MAGNITUDE PERMUTATIONS PER ENGINE CYCLE.
THE OCCURRENCE OF EACH OF THE MAGNITUDE PERMUTATIONS DEFINES THE START
OF INJECTION FOR A CORRESPONDING ONE OF THE FUEL INJECTORS. THE SET OF
TIMING SIGNALS IS COMBINED TO FORM A PAIR OF TIMING SIGNALS WHICH ARE
COMBINED TO FORM A SINGLE TIMING SIGNAL CONTAINING ALL OF THE
MAGNITUDE PERMUTATIONS. A SINGLE PULSE TRAIN DEVELOPED IN
SYNCHRONIZATION WITH THE SINGLE TIMING SIGNAL CONTAINS EIGHT CONTROL
PULSES PER ENGINE CYCLE. THE LENGTH OF EACH OF THE CONTROL PULSES
DEFINES THE PERIOD OF INJECTION FOR A CORRESPONDING ONE OF THE FUEL
INJECTORS IN TIME COMPRESSED NONOVERLAPPING RELATIONSHIP. THE SINGLE
PULSE TRAIN IS SEPARATED BY THE SINGLE TIMING SIGNALS TO FORM A PAIR
OF PULSE TRAINS WHICH ARE SEPARATED BY THE PAIR OF TIMING SIGNALS TO
FORM A SET OF FOUR PULSE TRAINS COLLECTIVELY CONTAINING ALL OF THE
CONTROL PULSES. THE LENGTH OF THE CONTROL PULSES IN THE SET OF PULSE
TRAINS IS EXTENDED TO DEFINE THE PERIOD OF INJECTION FOR THE FUEL
INJECTORS IN TIME EXPANDED OVERLAPPING RELATIONSHIP. LASTLY, THE SET
OF PULSE TRAINS IS SEPARATED BY THE SET OF TIMING SIGNALS TO FORM A
SERIES OF EIGHT PULSE TRAINS EACH CONTAINING CONTROL PULSES WHICH ARE
APPLIED TO ENERGIZE A CORRESPONDING ONE OF THE GROUP OF EIGHT FUEL
INJECTORS

509024   E7318684, C7310722
   A COMPUTER SYSTEM FOR PROCESS CONTROL AND PREDICTIVE MAINTENANCE OF
A DIESEL ENGINE ON A SEAGOING VESSEL
   DRAGER, K.H., LILAND, H.   ; DET NORSKE VERITAS, OSLO, NORWAY
   ; INSTRUMENT SOC. AMERICA
   STD BOOK NO.: 87664 190 9
   PROCEEDINGS OF THE 27TH ANNUAL ISA CONFERENCE   502/12PP.   1972
   9-12 OCT. 1972   INSTRUMENT SOC. AMERICA   NEW YORK, USA
   PUBL: INSTRUMENT SOC. AMERICA   PITTSBURGH, PA., USA
   DESCRIPTORS: MAINTENANCE ENGINEERING, INTERNAL COMBUSTION ENGINES,
PROCESS CONTROL, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS, SHIPS
   IDENTIFIERS: COMPUTER SYSTEM, PROCESS CONTROL, DIESEL ENGINE,
SEAGOING VESSEL, SENSORS, RING CONDITION, COMBUSTION, OPTIMAL
MAINTENANCE, COMPUTER HARDWARE, SOFTWARE SYSTEM, RELIABILITY, HEAT
SYSTEMS, TRANSPORTATION, MARINE SYSTEMS
   SECTION CLASS CODES: B5246, B1263, C7874, C7851, C8846
   UNIFIED CLASS CODES: TEGGAE, ADGDAL, VMRKAM, VMKCAD, WMEKAS
   THIS PAPER DESCRIBES A COMPUTER SYSTEM INSTALLED ONBOARD A LARGE
NORWEGIAN TANKER FOR PROCESS CONTROL AND PREDICTIVE MAINTENANCE OF THE
PROPULSION MACHINERY; A SULZER DIESEL ENGINE   (4 REFS)

499678   B7315469, C7308672
   VIRGULE VARIABLE-GEOMETRY WHEELED TELEOPERATOR
   VERTUT, J., GUILBAUD, J.-P., DEBRIE, G., GERMOND, J.-C., RICHE, F.
; COMM. ENERGIE ATOMIQUE, SACLAY, FRANCE
   FARMAKES, R.
   ; AMERICAN NUCLEAR SOC
   PROCEEDINGS OF THE 20TH CONFERENCE ON REMOTE SYSTEMS TECHNOLOGY
303-9   1972
   19-21 SEPT. 1972   AMERICAN NUCLEAR SOC   IDAHO FALLS, IDAHO, USA
   PUBL: AMERICAN NUCLEAR SOC.   HINSDALE, ILL., USA
   DESCRIPTORS: ROAD VEHICLES, TELECONTROL EQUIPMENT, DRIVES
   IDENTIFIERS: TV CAMERAS, DIGITAL COMMUNICATIONS LINK, MA22 MASTER
SLAVE MANIPULATORS, VARIABLE GEOMETRY WHEELED TELEOPERATOR, VIRGULE,
RADIO CONTROLLED RESCUE VEHICLE, BATTERY POWERED FOR SHORT TERM
OPERATIONS, PETROL ENGINE DRIVEN FOR LONG TERM OPERATIONS
   SECTION CLASS CODES: B5620, C7871, C7640
   UNIFIED CLASS CODES: TKEAAR, VMRCAZ, VKGAAW
   VIRGULE IS A FRENCH ACRONYM REFERRING TO A RADIO-CONTROLLED RESCUE
VEHICLE CAPABLE OF OPERATING OVER ROUGH TERRAIN EITHER INDOORS OR
OUTDOORS. THE TELEOPERATOR IS EQUIPPED WITH AT LEAST TWO TV CAMERAS
AND ONE PAIR OF MA22 MASTER-SLAVE MANIPULATORS, EACH CAPABLE OF
EXERTING 12-KG FORCES IN ANY DIRECTION, AND OF LIFTING UP TO 30 KG IN
CERTAIN POSITIONS. THE FOUR-WHEELED VEHICLE HAS MORE FLEXIBILITY THAN
A TRACK VEHICLE. IT CAN MOVE IN A STRAIGHT LINE IN ANY DIRECTION
(REFERRED TO ITS OWN AXIS) AND CAN STEER ABOUT ANY CENTER OF ROTATION,
CONTROLLED BY A SINGLE CONTROL HANDLE WITH THREE DEGREES-OF-FREEDOM.
WHEN THE VEHICLE IS MOVING, ONLY ONE ARM CAN BE OPERATED. A 24-CHANNEL
DIGITAL COMMUNICATIONS LINK IS USED FOR CONTROL, AND ANOTHER ONE FOR
FEEDBACK. THESE LINKS MAY BE RADIO OR COAXIAL CABLE. BATTERIES PROVIDE
SHORT-TERM AUTONOMOUS OPERATION; POWER MAINS (INDOORS) OR A
GASOLINE-ENGINE-DRIVEN GENERATOR (OUTDOORS) ARE USED FOR LONG
OPERATION   (8 REFS)

489560   B7311094, C7306088
DIGITAL ROTATION SPEED MEASUREMENT FOR INTERNAL-COMBUSTION ENGINES
LOSEL, M.E.
MESS. AND PRUEF. (GERMANY)   VOL.8, NO.9   539-41   SEPT. 1972
DESCRIPTORS: INTERNAL COMBUSTION ENGINES, FREQUENCY MEASUREMENT,
DIGITAL CIRCUITS, ANGULAR VELOCITY MEASUREMENT
   IDENTIFIERS: DIGITAL   MEASUREMENT, INTERNAL COMBUSTION ENGINE,
IGNITION PULSE, ROTATION SPEED MEASUREMENT, IGNITION IMPULSE FREQUENCY
, IGNITION IMPULSE INTERVAL
   SECTION CLASS CODES: B5246, B4455, C7455, B1870
   UNIFIED CLASS CODES: TEGGAE, BKEZAK, ETWAAP
   LANGUAGE: GERMAN
   FOR THE DIGITAL MEASUREMENT OF THE ROTATION SPEED OF AN INTERNAL
COMBUSTION ENGINE, THE IGNITION PULSE IS GENERALLY USED. TWO SOLUTIONS
ARE   DEALT   WITH: DETERMINING THE IGNITION-IMPULSE-FREQUENCY AND
DETERMINING THE IGNITION-IMPULSE-INTERVAL. BOTH SCHEMES ARE DESCRIBED

488746   B7311423, C7304089
PROCESS COMPUTER CONTROLS RETARDER AND HUMP SHUNTING ENGINE
HETZ, K.
DTSCH. EISENBAHNTECH. (GERMANY)   VOL.20, NO.11   490-4   NOV. 1972
CODEN: DEBTAN
   DESCRIPTORS: LOCOMOTIVES,   CONTROL   ENGINEERING APPLICATIONS OF
COMPUTERS, BRAKES, PROCESS CONTROL
   IDENTIFIERS: RETARDER, HUMP SHUNTING ENGINE, EFFICIENCY, HUMP,
PROCESS COMPUTER CONTROL
   SECTION CLASS CODES: B5620, C7872, C8846, C8849
   UNIFIED CLASS CODES: TKBAAB, VHEBAK, WHPKAS, WHPZAN
   LANGUAGE: GERMAN
   THE EFFICIENCY OF A HUMP IS DECISIVELY DETERMINED BY THE TIMES OF
LOSS AND SHUNTING SPEED. AN INSTALLATION AT THE GOODS STATION OF HALLE
IS PRESENTED WHERE THE EFFICIENCY WAS INCREASED BY 5.5 PER CENT UNDER
EXPERIMENTAL CONDITIONS

488701　R7311364, C7303952
MODIFICATION OF A FUEL-CELL ENGINE FOR CONTROL BY A DIGITAL COMPUTER
HAGEDORN, N.H.
REPORT NO.: NASA-TM-X-2575　　ISSUED BY: NASA, CLEVELAND, OHIO, USA
JUNE 1972
DESCRIPTORS: FUEL　CELLS, CONTROL　ENGINEERING　APPLICATIONS　OF
COMPUTERS, ELECTRICAL ENGINEERING APPLICATIONS OF COMPUTERS
IDENTIFIERS: DIGITAL　COMPUTER, SOLENOID VALVES, TRANSDUCERS, LIMIT
SWITCHES, LOAD, ELECTROLYTE CONCENTRATION, SYSTEM SHUTDOWN, FUEL CELL
ENGINE, DIRECT ENERGY CONVERSION
　　SECTION CLASS CODES: B5416, C7856, C8841, C8846
　　UNIFIED CLASS CODES: EVCGAH, VMKKAR, WMECAE, WMEKAS
　　AVAILIABILITY: NTIS, SPRINGFIELD, VA. 22151, USA
　　A　MANUALLY OPERATED FUEL-CELL SYSTEM WAS MODIFIED TO BE MONITORED
AND　CONTROLLED　BY A DIGITAL COMPUTER. THE PURPOSE WAS TO HAVE A TEST
ITEM　WITH WHICH TO STUDY POSSIBLE SYSTEM-COMPUTER INTERFACE PROBLEMS.
THE　MODIFICATION　CONSISTED OF INSTALLING SOLENOID VALVES, CIRCUITRY,
TRANSDUCERS, AND　LIMIT　SWITCHES　ON THE SYSTEM. THESE MODIFICATIONS
PERMIT　COMPUTER　CONTROL　OF　LOAD　CURRENT, REACTANT PURGE, WATER
REMOVAL, AND　ELECTROLYTE　CONCENTRATION　AND　COMPUTER INITIATION OF
SYSTEM SHUTDOWN

480219　R7307008, C7304913
WASTE GAS UTILISATION IN MARINE ENGINE INSTALLATIONS
BEHLORADSKY, H.-J.
BRENNST.-WAERME-KRAFT　(BWK)　(GERMANY)　　VOL. 24, NO. 11　411-15
NOV. 1972　CODEN: BRWKAY
　DESCRIPTORS:　BOILERS, STEAM PLANTS, MARINE SYSTEMS, COMPUTER-AIDED
DESIGN, SHIPS
　IDENTIFIERS:　COMPUTER　PROGRAMMES, LOAD DEPENDENT BEHAVIOUR, WASTE
GAS　UTILISATION, MARINE ENGINE INSTALLATIONS, OPERATIONAL EFFICIENCY,
THERMAL　ENERGY, STEAM　TURBINE, TURBOGENERATOR, DESIGN, WASTE GAS
BOILER PLANTS
　　SECTION CLASS CODES: F5202, C8841
　　UNIFIED CLASS CODES: TEGCAB, WMECAB
　　LANGUAGE: GERMAN
　　WASTE HEAT BOILER PLANTS APPEAR PARTICULARLY SUITABLE TO IMPROVE THE
TOTAL OPERATIONAL EFFICIENCY. PART OF THE THERMAL ENERGY OF THE ENGINE
WASTE　GASES　CAN　BE　TRANSMITTED IN A WASTE HEAT BOILER TO A WORKING
MEDIUM　WHICH　FLOWS　THROUGH A SEPARATE CYCLE, FOR INSTANCE THE STEAM
TURBINE　OF A TURBOGENERATOR. COMPUTER PROGRAMS FOR FULL AND PART-LOAD
CONDITIONS　HAVE　BEEN　DEVELOPED　FOR　THE DESIGN OF WASTE GAS BOILER
PLANTS. WASTE　HEAT　BOILERS　FOR　TWO　ENGINE INSTALLATIONS HAVE BEEN
DESIGNED　TAKING　CERTAIN　RESTRICTIONS　INTO CONSIDERATION, AND THEIR
LOAD-DEPENDENT　BEHAVIOUR PREDICTED, BASED ON CALCULATED RESULTS　(13
REFS)

479296   C730391P
  COMPUTER CONTROLLED ENGINE TESTING
  TAYLOR, J.C.   ; LONDON COLL. PRINTING, ENGLAND
  ; IEE, INST. MECH. ENGRS
  COLLOQUIUM   DIGEST   ON   CONTROL   APPLICATIONS   OF   MINI-COMPUTERS
5/1-6PP.   1972
  13 DEC. 1972   IEE, INST. MECH. ENGRS   LONDON, ENGLAND
  PUBL: IEE   LONDON, ENGLAND
  DESCRIPTORS: HEAT   ENGINES,   AUTOMATIC TESTING, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS
  IDENTIFIERS: COMPUTER CONTROLLED, ENGINE TESTING, TEST BEDS, SPC 16,
PETROL ENGINES, DIESEL ENGINES
  SECTION CLASS CODES: C7851, C8846, C8849
  UNIFIED CLASS CODES: VMKCAD, WMEKAS, WMEZAN
  DESCRIBES TWO ENGINE TEST BEDS THAT HAVE BEEN BUILT AND FULLY
INSTRUMENTED FOR COMPUTER CONTROL. THE TWO TEST BEDS ARE CONTROLLED
LOCALLY WITH ANALOGUE 3-TERM CONTROLLERS IN EACH CONTROL LOOP. THE
SET-POINT INPUTS TO THE CONTROLLERS CAN BE SWITCHED SO THAT EITHER
LOCAL MANUAL CONTROL OR CONTROL FROM ANALOGUE OUTPUT FROM A DIGITAL
COMPUTER IS POSSIBLE. THE TWO BEDS ARE LINKED TO A GENERAL AUTOMATION
SPC 16 DIGITAL COMPUTER VIA AN INTERFACE

466783   C7302327
  GENERALIZED SIMULATION TECHNIQUE FOR TURBOJET ENGINE SYSTEM ANALYSIS
  SELDNER, K., MIHALOEW, J.R., BLAHA, R.J.
  REPORT NO.: NASA-TN-D-6610   ISSUED BY: NASA, CLEVELAND, OHIO, USA
  FEB. 1972
  DESCRIPTORS: HEAT ENGINES, AEROSPACE APPLICATIONS OF COMPUTERS,
ANALOGUE COMPUTER METHODS, SIMULATION, COMPUTER-AIDED ANALYSIS
  IDENTIFIERS: GENERALIZED SIMULATION TECHNIQUE, TURBOJET ENGINE
SYSTEM ANALYSIS, PROPULSION SYSTEM DYNAMICS, CONTROLS RESEARCH,
SCHEMATIC   MODEL,   BASIC   CONSERVATION EQUATIONS, PERFORMANCE
CHARACTERISTICS, NONLINEAR ANALOGUE SIMULATION, ANALOGUE COMPUTER
  SECTION CLASS CODES: C8849, C9980
  UNIFIED CLASS CODES: WMEZAN, XTMAAH
  AVAILIABILITY: NTIS, SPRINGFIELD, VA. 22151, USA
  A NONLINEAR ANALOG SIMULATION OF A TURBOJET ENGINE WAS DEVELOPED.
THE PURPOSE OF THE STUDY WAS TO ESTABLISH SIMULATION TECHNIQUES
APPLICABLE TO PROPULSION SYSTEM DYNAMICS AND CONTROLS RESEARCH. A
SCHEMATIC MODEL WAS DERIVED FROM A PHYSICAL DESCRIPTION OF A J85-13
TURBOJET ENGINE. BASIC CONSERVATION EQUATIONS WERE APPLIED TO EACH
COMPONENT ALONG WITH THEIR INDIVIDUAL PERFORMANCE CHARACTERISTICS TO
DERIVE A MATHEMATICAL REPRESENTATION. THE SIMULATION WAS MECHANIZED ON
AN ANALOG COMPUTER. THE SIMULATION WAS VERIFIED IN BOTH STEADY-STATE
AND DYNAMIC MODES BY COMPARING ANALYTICAL RESULTS WITH EXPERIMENTAL
DATA OBTAINED FROM TESTS PERFORMED AT THE LEWIS RESEARCH CENTER WITH A
J85-13 ENGINE. IN ADDITION, COMPARISON WAS ALSO MADE WITH PERFORMANCE
DATA OBTAINED FROM THE ENGINE MANUFACTURER. THE COMPARISONS
ESTABLISHED THE VALIDITY OF THE SIMULATION TECHNIQUE

NAEC-92-139

466776   B7303350, C7302320
   EXPERIMENTAL VERIFICATION OF A DIGITAL COMPUTER SIMULATION METHOD
FOR PREDICTING GAS TURBINE DYNAMIC BEHAVIOUR
   FAWKE, A.J., SARAVANAMUTTOO, H.I.H., HOLMES, M.   ; GAS COUNCIL
ENGNG. RES. STATION, NEWCASTLE UPON TYNE, ENGLAND
   PROC. INST. MECH. ENG. (GB)   VOL.186, PT.27   323-9   1972   CODEN:
PIMLAA
   DESCRIPTORS: GAS TURBINES, TRANSIENT RESPONSE, SIMULATION,
ENGINEERING APPLICATIONS OF COMPUTERS, MECHANICAL ENGINEERING
   IDENTIFIERS: EXPERIMENTAL VERIFICATION, DIGITAL COMPUTER SIMULATION
METHOD, GAS TURBINE, DYNAMIC BEHAVIOUR, MATHEMATICAL MODEL, TRANSIENT
RESPONSE, TEST RESULTS, TWIN SPOOL GAS TURBINE ENGINE
   SECTION CLASS CODES: B5244, C8849
   UNIFIED CLASS CODES: TEGEAT, WMEZAN
   A MATHEMATICAL MODEL WHICH SIMULATES THE TRANSIENT RESPONSE OF A
TWIN-SPOOL GAS TURBINE ENGINE ON A GENERAL PURPOSE DIGITAL COMPUTER IS
DESCRIBED TOGETHER WITH TEST RESULTS VERIFYING THE SIMULATION   (5
REFS)

466770   C7302312
   COMPUTER DIAGNOSIS OF THE VW
   KAMINSKI, R.K.
   INSTRUM. TECHNOL. (USA)   VOL. 19, NO. 9   60-2   SEPT. 1972
CODEN: IRTCA4
   DESCRIPTORS: SPECIAL PURPOSE COMPUTERS, VEHICLES, AUTOMATIC TEST
EQUIPMENT, COMPUTER ARCHITECTURE, ENGINEERING APPLICATIONS OF
COMPUTERS
   IDENTIFIERS: SPECIAL PURPOSE COMPUTER, COMPUTER DIAGNOSIS, ENGINE,
HARDWARE, TEST PROCEDURES, IGNITION PERFORMANCE, ENGINE COMPRESSION
   SECTION CLASS CODES: C8849, C9840
   UNIFIED CLASS CODES: WMEZAN, XREAAF
   SINCE MID-1971, ALL VOLKSWAGENS HAVE BEEN EQUIPPED FOR A UNIQUE VW
COMPUTER DIAGNOSIS, MORE THAN 60 SEPARATE CHECKS TO DETERMINE THE
CONDITION OF A CAR HAVE BEEN MADE. EACH OF THESE VWS CONTAIN SENSORS
AND WIRING WHICH ARE CONNECTED TO A SOCKET IN THE ENGINE COMPARTMENT.
AT THE DEALER:S SERVICE CENTER, AN UMBILICAL CORD WILL TIE THE VW TO A
SPECIAL-PURPOSE COMPUTER AND THE APPROXIMATELY 21-MINUTE CHECKOUT WILL
BEGIN. SYSTEM HARDWARE AND TEST PROCEDURES ARE EXPLAINED IN THIS
ARTICLE   (3 REFS)

466769   B7302803, C7302311
  DESIGNING DIGITAL DATA ACQUISITION SYSTEMS
  WESTWICK, J.E.
  INSTRUM. TECHNOL. (USA)   VOL. 19, NO. 9   45-9   SEPT. 1972
CODEN: IRTCA4
  DESCRIPTORS: COMPUTER GRAPHICS, DATA ACQUISITION, AEROSPACE
APPLICATIONS OF   COMPUTERS,   AEROSPACE   ENGINES, AEROSPACE TEST
FACILITIES, GAS TURBINES, TESTING
  IDENTIFIERS: DESIGNING, DIGITAL DATA ACQUISITION SYSTEMS, COMPUTER
HARDWARE, AEROSPACE, INDUSTRIAL GAS TURBINE ENGINE DEVELOPMENT, HIGH
SPEED, DISPLAY, TEST ENGINEER, GRAPHIC, TABULAR FORM, REAL TIME
PERFORMANCE, REAL TIME MONITOR SOFTWARE, SOLID STATE HARDWARE
  SECTION CLASS CODES: C8849, C8440, B4740
  UNIFIED CLASS CODES: WMEZAN, WGEAAJ, ZLGAAP
  DIGITAL DATA ACQUISITION SYSTEM DEVELOPMENT AND DESIGN HAVE BECOME
MORE SOPHISTICATED WITH THE AVAILABILITY OF SOLID-STATE COMPUTER
HARDWARE AND REAL-TIME MONITOR SOFTWARE. A NEW SYSTEM, BASED ON DESIGN
GUIDELINES REVIEWED IN THIS ARTICLE, AT GM:S DETROIT DIESEL ALLISON
DIVISION   SUPPORTS   AEROSPACE AND INDUSTRIAL GAS TURBINE ENGINE
DEVELOPMENT PROGRAMS. THE COMPUTER-BASED SYSTEM PROVIDES HIGH SPEED
ACQUISITION OF DATA, DISPLAY OF REAL-TIME PERFORMANCE TO THE TEST
ENGINEER AND QUICK RETURN OF FINAL PERFORMANCE RESULTS IN GRAPHIC AND
TABULAR FORM

466713   C7302255
  SOLUTION OF DYNAMICS OF INDIRECT CONTROL OF SHIP-PROPULSION SETS ON
AN ANALOGUE COMPUTER APPLIED TO THE CKD TYPE 6L 525 II PV MARINE
ENGINE
  SOBRT, M.
  CZECH. HEAVY IND. (CZECHOSLOVAKIA)   NO.1   18-25   1972   CODEN:
CZHIAK
  DESCRIPTORS: STABILITY, NON-LINEAR SYSTEMS, CONTROLLERS, ANALOGUE
COMPUTER METHODS, MARINE SYSTEMS, HEAT SYSTEMS, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS
  IDENTIFIERS: ANALOGUE COMPUTER, MARINE ENGINE, DIESEL ENGINE,
CONTROL SYSTEMS, PROPORTIONAL PLUS INTEGRAL, CONTROLLER, PROPELLER,
GENERATOR, CENTRIFUGAL GOVERNOR, DISTRIBUTION GEAR WITH SLIDE VALVE,
SERVOPISTON, ELASTIC FEEDBACK, DROOP, SHIP PROPULSION SETS, HARMONIC
DISTURBANCES, LOAD STEP CHANGES, CONSTANT SPEED STABILISER
  SECTION CLASS CODES: C8846, C9980, C6620, C6690
  UNIFIED CLASS CODES: WMEKAS, XTMAAH, VEEAAV, VEVAAC
  FOR RELIABLE AND SAFE OPERATION OF SHIP-PROBLEM SETS WITH DIESEL
ENGINES, THE BEHAVIOUR OF THESE SETS AS CONTROL SYSTEMS MUST BE KNOWN
IN ADVANCE. THE EXISTING METHODS DO NOT ENABLE THE PROPERTIES OF THESE
SETS TO BE DETERMINED WITH ADEQUATE ACCURACY AND THE TESTS TO BE
CARRIED OUT ON FINISHED SETS LEAVING THE FACTORY. AN ANALOGUE COMPUTER
SOLUTION TO THIS NONLINEAR PROBLEM IS OFFERED. A PROPORTIONAL PLUS
INTEGRAL CONTROLLER IS USED IN A SYSTEM OF DIESEL ENGINE, GEAR BOX AND
PROPELLER OR GENERATOR. THE BEHAVIOUR WAS STUDIED FOR STORMY WEATHER
CONDITIONS

465706   E7302810, C7301131
NERVA FLIGHT ENGINE CONTROL SYSTEM DESIGN
 NORMAN, H.H., PARZIALE, E.A., SALOJA, J.K., SCHENZ, R.F., JR.   :
WESTINGHOUSE ELECTRIC CORP., SACRAMENTO, CALIF., USA
 NUCL. TECHNOL. (USA)   VOL.15, NO.3   447-54 1972   CODEN: NUTYBB
 DESCRIPTORS: AEROSPACE PROPULSION, AUTOMATIC CONTROL APPLICATIONS,
NUCLEAR POWER, NUCLEAR SYSTEMS, AEROSPACE CONTROL
 IDENTIFIERS: NERVA FLIGHT ENGINE CONTROL SYSTEM DESIGN, NUCLEAR
ROCKET ENGINE, MULTILOOP CLASSICAL CONTROLS DESIGN APPROACH, HIGH
DEGREE OF COUPLING, MULTIVARIABLE NATURE, SYSTEM MODEL LINEARIZATION,
SYSTEM SIMPLIFICATION, QUADRATIC OPTIMAL CONTROL DESIGN, TRANSIENT
PERFORMANCE, DIGITAL IMPLEMENTATION
 SECTION CLASS CODES: C7854, B4760
 UNIFIED CLASS CODES: VMKGAA, ZLKAAM
 MODERN CONTROL SYSTEM THEORY HAS BEEN APPLIED TO THE DESIGN OF THE
CONTROL SYSTEM FOR THE NERVA NUCLEAR ROCKET ENGINE. MULTILOOP
CLASSICAL CONTROLS DESIGN APPROACH HAS BEEN USED PREVIOUSLY IN THE
ENGINE TEST PROGRAM. THE CONFIGURATION AND OPERATION OF THE ENGINE
SYSTEM WITH THE RESULTING HIGH DEGREE OF COUPLING AND THE
MULTIVARIABLE NATURE OF THE SYSTEM ESTABLISHES A NEED FOR MODERN
CONTROL TECHNIQUES WITH CONSIDERABLE ADVANTAGES OVER CLASSICAL
METHODS. THE DESIGN PROCEDURE CONSISTS OF SYSTEM MODEL LINEARIZATION,
SYSTEM SIMPLIFICATION, AND THE QUADRATIC OPTIMAL CONTROL DESIGN.
TRANSIENT PERFORMANCE RESULTS HAVE BEEN OBTAINED FROM DIGITAL
IMPLEMENTATION OF THE CONTROL SYSTEM

465689   C7301114
DIGITAL CONTROL OF AN INTERNAL COMBUSTION ENGINE: THE INTERFACE
DESIGN PROCESS
 NICHOLS, J.A., ALLAN, J.J., III   ; MCDONNELL DOUGLAS CORP.,
HUNTINGTON BEACH, CALIF., USA
 ; US DEPT. COMMERCE, IEEE
 PROCEEDINGS OF THE TECHNICAL CONFERENCE :ISLANDS OF APPLICATION:
157-65   1972
 8-13 JUNE 1972   US DEPT. COMMERCE, IEEE   TOKYO, JAPAN
 PUBL: IEEE   NEW YORK, USA
 DESCRIPTORS: INTERNAL COMBUSTION ENGINES, DIGITAL CONTROL
 IDENTIFIERS: DIGITAL CONTROL, INTERNAL COMBUSTION ENGINE, INTERFACE
DESIGN PROCESS, POWER OUTPUT, FUEL CONSUMPTION, OPERATING TEMPERATURES
, EXHAUST EMISSIONS
 SECTION CLASS CODES: C7851, C8846, C8849
 UNIFIED CLASS CODES: VMKCAD, WMPKAS, WMEZAN
 A DIGITALLY CONTROLLED TEST BED FOR INTERNAL COMBUSTION ENGINES HAS
BEEN BUILT AND TESTED. THE PURPOSE OF THE WORK, HOWEVER, WAS TO
EXAMINE THE INTERFACE DESIGN PROCESS. THE INTERFACE DESIGN PROCESS IS
DEVELOPED IN GENERIC AND THEN SPECIFIC TERMS. THE DEVELOPMENT OF THE
IC ENGINE TEST BED FACILITY IS THEN DESCRIBED AS AN EXAMPLE OF THE
METHOD. SPECIFIC RESULTS ARE GIVEN FOR THE PARTICULAR APPLICATION, AND
THE GENERAL APPROACH IS EVALUATED   (1 REFS)

465649   C7301074
THEORETICAL DESIGN OF AN ADAPTIVE CONTROLLER FOR AN I.C. ENGINE
GILL, K.F., HARLAND, G.E., SCHWARZENBACH, J.
CONTR. AND INSTRUM. (GB)   VOL.4, NO.9   50-3   OCT. 1972   CODEN:
CTLIAW
DESCRIPTORS: HEAT ENGINES, ANALOGUE COMPUTER METHODS, ADAPTIVE
CONTROL
IDENTIFIERS: ANALOGUE   COMPUTER,   THEORETICAL   DESIGN,   ADAPTIVE
CONTROLLER, INTERNAL COMBUSTION ENGINE, SPEED CONTROL
SECTION CLASS CODES: C7851, C6660, C9980, C8846
UNIFIED CLASS CODES: VMKCAD, VENAAG, XTMAAH, WMEKAS
AN   I.C.   ENGINE-SPEED   CONTROL   SYSTEM   HAS   BEEN   INVESTIGATED
THEORETICALLY ON AN ANALOGUE COMPUTER TO DETERMINE THE DEGREE OF
IMPROVEMENT IN EXISTING SPEED-CONTROL SYSTEMS THAT CAN BE OBTAINED BY
USING ADAPTIVE TECHNIQUES   (3 REFS)

465648   C7301073
COMPUTER CONTROL FOR IC ENGINES DEVELOPMENT
BLOXHAM, R.D., JONES, T.P., MURGATROYD, W., WING, R.D.
CHART. MECH. ENG. (GB)   VOL.9, NO.9   58-61   OCT. 1972   CODEN:
CHMGAF
DESCRIPTORS: HEAT   ENGINES,   CONTROL   ENGINEERING   APPLICATIONS   OF
COMPUTERS
IDENTIFIERS: INTERNAL   COMBUSTION   ENGINES,   REAL   TIME   COMPUTING,
COMPUTER   CONTROL,   DEVELOPMENT,   OPTIMUM EQUIPMENT, PROGRAMMING, TEST
FACILITY,   ENVIRONMENTAL   STUDIES,   CYCLIC   FLUCTUATIONS,   PERKINS
PRODUCTION DIESEL ENGINE
SECTION CLASS CODES: C7851, C8846, C8849
UNIFIED CLASS CODES: VMKCAD, WMEKAS, WMEZAN
DEVELOPMENT OF THE OPTIMUM EQUIPMENT AND PROGRAMMING NECESSARY FOR A
VERSATILE COMPUTER-CONTROLLED IC ENGINES TEST FACILITY HAS BEEN
CARRIED OUT IN THE MECHANICAL ENGINEERING DEPARTMENT AT IMPERICAL
COLLEGE, LONDON. ENVIRONMENTAL STUDIES OF A WIDELY VARYING NATURE HAVE
BEEN THE PRIMARY OBJECTIVE AND THE FACILITY HAS ENORMOUS POTENTIAL FOR
GENERAL ENGINE RESEARCH PARTICULARLY IN THE DEVELOPMENT STAGES OF
PRODUCTION   ENGINES.   THE   OVERALL   PERFORMANCE   OF   THIS   PROTOTYPE
ALL-DIGITAL CONTROL AND ANALYSIS SYSTEM HAS ALREADY SHOWN TIME SAVINGS
OF 10:1 IN PRE-PRODUCTION TESTING FOR ONE MOTOR MANUFACTURER. THE
GENERAL AIMS OF THE PROJECT ARE TWOFOLD: (I) TO DEMONSTRATE THE USE OF
COMPUTERS IN ENGINE DEVELOPMENT; (II) TO PROVIDE THE BASIC FACILITIES
REQUIRED   FOR   SOPHISTICATED   EXPERIMENTS   ASSOCIATED   WITH   ENGINES
RESEARCH AND TO DEMONSTRATE THE POTENTIAL OF REAL-TIME COMPUTING IN
THIS CONNECTION. THE FIRST DEMONSTRATION OF THIS KIND, RELATED TO
CYCLIC   FLUCTUATIONS   ON   A   PERKINS   PRODUCTION   DIESEL   ENGINE,   IS
DESCRIBED

455590   C7225377
A FLUIDIC SENSOR FOR CLOSED LOOP ENGINE ACCELERATION CONTROL
WETZEL, A.J., ARNETT, S.E., HIGH, R.
FLUID. Q. (USA)   VOL.4, NO.2   68-79   APRIL 1972   CODEN: FLQUA2
DESCRIPTORS: HEAT ENGINES, ACCELERATION CONTROL, FLUIDICS,
NONELECTRIC SENSING DEVICES, CONTROL ENGINEERING APPLICATIONS OF
COMPUTERS
IDENTIFIERS: FLUIDIC SENSOR, CLOSED LOOP, ENGINE ACCELERATION
CONTROL, HYBRID CONTROLLER, COMPUTER, FUEL CONTROL, TURBO GAS
GENERATOR ENGINES
SECTION CLASS CODES: C7551, C7322, C7422, C8825
AN ANALYTICAL AND DEMONSTRATION PROGRAM WAS CONDUCTED TO EVALUATE
THE APPLICABILITY OF A UNIQUE ACCELERATION PARAMETER FOR TURBO-GAS
GENERATOR ENGINES. THIS PARAMETER IS THE ENGINE AIRFLOW GENERALIZED TO
THE COMPRESSOR DISCHARGE STATION. CONTROL-ENGINE TESTS WERE CONDUCTED
USING A HYBRID CONTROL SYSTEM AND A J85-GE-7 ENGINE. THE HYBRID
CONTROLLER CONSISTED OF FLUIDIC AND ELECTRONIC SENSORS, THE AFAPL IBM
1800 COMPUTER AND AN ELECTROHYDROMECHANICAL FUEL CONTROL. IN THIS
PAPER THE FINDINGS OF THE PROGRAM, WITH PARTICULAR EMPHASIS ON THE
FEATURES OF A FLUIDIC SENSOR WHICH WAS USED TO MEASURE THE PARAMETER,
AND THE CONTROL PROGRAMMING FLEXIBILITY AVAILABLE WITH THE IBM 1800
ARE DISCUSSED

447278   C7224258
REMOTE TEST SITE COMPUTATION OF COMPLEX ENGINE INLET DYNAMIC
PARAMETERS USING AN ANALOG COMPUTER
SMITH, R.L., FLEETWOOD, P.M.   : MCDONNELL AIRCRAFT CO., ST. LOUIS,
MO., USA
ISA TRANS. (USA)   VOL.11, NO.1   56-64   1972   CODEN: ISATAZ
DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, REAL TIME SYSTEMS,
ANALOGUE COMPUTER METHODS, HEAT ENGINES
IDENTIFIERS: REAL TIME COMPUTATION, DISPLAY, ANALOGUE COMPUTER,
REMOTE TEST SITE COMPUTATION, COMPLEX ENGINE INLET DYNAMIC PARAMETERS,
DYNAMIC PRESSURE DATA SIGNALS, INTEGRATED CIRCUIT OPERATIONAL
AMPLIFIERS, PRATT AND WHITNEY ENGINE PARAMETERS, HARDWARE,
COMPUTATIONAL CIRCUITRY, FLAGGING PULSES, DIGITIZATION, COMPUTER
ANALYSIS
SECTION CLASS CODES: C8829, C9950
A SYSTEM TO PROVIDE REAL-TIME COMPUTATION AND DISPLAY OF COMPLEX
ENGINE INLET DISTORTION PARAMETERS, COMPUTED FROM A LARGE NUMBER OF
DYNAMIC PRESSURE DATA SIGNALS, WAS SUCCESSFULLY IMPLEMENTED USING
INTEGRATED CIRCUIT OPERATIONAL AMPLIFIERS AS THE PRIMARY ANALOGUE
COMPUTATIONAL ELEMENTS. PRATT AND WHITNEY ENGINE PARAMETERS ARE SHOWN
AND HARDWARE DIAGRAMS OF THE COMPUTATIONAL CIRCUITRY ARE EXPLAINED.
ALSO SHOWN IS HOW THE SYSTEM PROVIDED FLAGGING PULSES TO THE RAW DATA
TAPES FOR SUBSEQUENT DIGITIZATION AND COMPUTER ANALYSIS OF :WORST
CASE: DATA, WITH RESULTANT IMPROVEMENT IN TEST DATA AT SIGNIFICANT
SAVINGS IN TIME AND MONEY   (4 REFS)

446709   C7223638
THE VIBRATION OF ENGINE CRANKSHAFTS-A FAST NUMERICAL SOLUTION
CRAVEN, A.H., HOLMES, R.   ; UNIV. SUSSEX, BRIGHTON, ENGLAND
INT. J. NUMER. METH. ENG. (GB)   VOL. 5, NO. 1   17-24   SEPT.-OCT.
1972   CODEN: IJNMBH
DESCRIPTORS: NUMERICAL METHODS, PHYSICS
IDENTIFIERS: VIBRATION, ENGINE CRANKSHAFTS, FAST NUMERICAL SOLUTION,
DYNAMICAL EQUATIONS, MOTION, CLEARANCE TOLERANCE, BEARING, MINIMUM
FILM THICKNESS, CLEARANCE TOLERANCE, COMPUTER TIME
SECTION CLASS CODES: C8240
THIS PAPER DESCRIBES A VERY FAST NUMERICAL METHOD FOR SOLVING THE
FULL DYNAMICAL EQUATIONS GOVERNING THE MOTION OF THE CRANKSHAFT AND,
AS AN EXAMPLE, THE METHOD IS USED TO CALCULATE THE EFFECT OF CLEARANCE
TOLERANCE ON THE PERFORMANCE OF A TYPICAL BEARING. IT WAS FOUND THAT
THE MINIMUM FILM THICKNESS IS NOT GREATLY AFFECTED BY THE CLEARANCE
TOLERANCE, SUGGESTING THAT A FAIR DEGREE OF VARIATION OF CLEARANCE CAN
BE ALLOWED   (3 REFS)

436915   C7222538
TURBINE TORQUE COMPUTER
PATENT NO.: UK   1266262   ASSIGNEES: BENDIX CORP.   FILED: 20 MARCH
1970
ORIGINAL PATENT APPL. NO.: USA   810668
PRIORITY DATE: 26 MAR 1969
8 MARCH 1972
DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, TURBINES, TORQUE
MEASUREMENT, AEROSPACE APPLICATIONS OF COMPUTERS, SPECIAL PURPOSE
COMPUTERS
IDENTIFIERS: TURBINE TORQUE COMPUTER, HELICOPTERS, RESERVE
CAPABILITY, STATIC PRESSURE, AMBIENT TEMPERATURE SIGNALS, ADJUSTMENT
DEVICE, ENGINE CHARACTERISTICS, COMPENSATE
SECTION CLASS CODES: C9650, C8829
A TURBINE TORQUE COMPUTER IS DISCLOSED FOR HELICOPTERS. IT COMPUTES
THE RESERVE CAPABILITY OF THE TURBINE BY OPERATING ON STATIC PRESSURE
AND AMBIENT TEMPERATURE SIGNALS, TO PRODUCE A SIGNAL CORRESPONDING TO
RATED TORQUE AT THAT PRESSURE AND TEMPERATURE. OPERATING ON THIS
SIGNAL AND A SIGNAL CORRESPONDING TO THE TORQUE OUTPUT OF THE TURBINE,
IT PRODUCES A SIGNAL CORRESPONDING TO PERCENTAGE MAXIMUM RATED TORQUE
BEING PRODUCED BY THE ENGINE. PREFERABLY A SUBNORMAL ADJUSTMENT DEVICE
IS CONNECTED BETWEEN THE TWO PARTS OF THE COMPUTER FOR ADJUSTING THE
RATED TORQUE SIGNAL TO COMPENSATE FOR SUB-NORMAL ENGINE
CHARACTERISTICS

436519   A7258940, C7222131
AN ANALYSIS OF EACH ENGINE CYCLE USING A DIGITAL ELECTRONIC COMPUTER
HIGASHINO, I., YOSHIMURA, K.   ; OSAKA CITY UNIV., JAPAN
MEM. FAC. ENG. OSAKA CITY UNIV. (JAPAN)   VOL.12   25-37   DEC. 1971
   CODEN: MFEOAR
DESCRIPTORS: COMBUSTION,   COMPUTER APPLICATIONS, HEAT ENGINES,
ENGINEERING APPLICATIONS OF COMPUTERS, ANALOGUE-DIGITAL CONVERSION
   IDENTIFIERS: A/D CONVERTORS, DIGITAL ELECTRONIC COMPUTER, DIGITAL
DATA   PROCESSING   DEVICE,   INSTANTANEOUS   CHARACTERISTIC   VALUES,
COMBUSTION,   CYLINDER   PRESSURE,   INTERNAL   COMBUSTION   ENGINE,   GAS
CONDITION, POWER UP, EXHAUST GAS CLEANING, CYCLE SIMULATION, ANALOGUE
DATA RECORDER
   SECTION CLASS CODES: A0400, C8829, A0240

   THE   COMBUSTION   IN   A   CYLINDER   OF   AN   INTERNAL   COMBUSTION   ENGINE   IS
COMPLETED   IN   A   VERY   SHORT   TIME,   AND   ALSO   VARIOUSLY   INFLUENCED   BY   MANY
FACTORS.   IN   VIEW   OF   THE   FACT   THAT   COMBUSTION   CHANGES   CYCLE   TO   CYCLE,
IT   IS   VERY   DIFFICULT   IN   TECHNIQUE   TO   KNOW   THE   GAS   CONDITION   IN   A
CYLINDER   DIRECTLY.   BUT   IT   IS   ESSENTIALLY   NECESSARY   TO   ANALYZE   AND
ESTIMATE   A   COMBUSTION   CONDITION   CYCLE   TO   CYCLE   IN   ORDER   TO   SOLVE   THE
PROBLEM   OF   POWER   UP   OR   EXHAUST   GAS   CLEANING.   IN   OTHER   HAND,   FOR
ANALYZING   A   COMBUSTION   CONDITION,   PROCEDURE   OF   CYCLE   SIMULATION   IS
USED.   IN   THIS   CASE,   IT   IS   NOT   EASY   TO   ESTIMATE   HEAT   RELEASE   RATE   OF   A
PRE-MIXTURE   ENGINE   IN   COMPARISON   WITH   A   FUEL   INJECTION   ENGINE.   IN   THIS
PAPER,   IN   ORDER   TO   ANALYZE   AND   ESTIMATE   A   COMBUSTION,   THE   PRESSURE
VALUE   IN   A   CYLINDER,   WHICH   CAN   BE   MEASURED   RELATIVELY   EASILY   AS   AN
INSTANTANEOUS   VALUE,   IS   MEASURED   WITH   USE   OF   AN   ANALOGUE   DATA   RECORDER
AND   ITS   DATA   IS   TRANSFORMED   TO   DIGITAL   DATA   BY   A-D   CONVERTOR.   AFTER
THIS   PROCEDURE   BY   USING   A   DIGITAL   ELECTRONIC   COMPUTER   AND   THIS   DIGITAL
PRESSURE   DATA,   SOME   CHARACTERISTIC   VALUES   OF   COMBUSTION   ARE   CALCULATED
AT   EACH   POINT   OF   A   SMALL   CRANK   ANGLE   INTERVAL,   FOR   EXAMPLE,   THE
POLYTROPIC   EXPONENT,   THE   RATE   OF   PRESSURE   INCREASE,   THE   RATE   OF
CYLINDER   VOLUME   CHANGE,   THE   GAS   TEMPERATURE,   THE   SPECIFIC   HEAT   RATIO
AND   THE   RATE   OF   GAS   HEATING.   AND   THEN   THE   MEAN   EFFECTIVE   PRESSURE   AND
THE   TOTAL   HEAT   RELEASE   ARE   CALCULATED   (5 REFS)

435441   C7220939
ENGINE   SPEED   AND   CLUTCH   SYNCHRONIZING   CONTROLS   INCLUDING
TRANSMISSION CONTROLS
NOMAZAWA, A., ITO, O.
PATENT NO.: USA   3645366   ASSIGNEES: NIPPONDENSO, K.K.   FILED: 1
JUNE 1970
ORIGINAL PATENT APPL. NO.: JAPAN   44/43885
PRIORITY DATE: 3 JUN 1969
29 FEB. 1972
DESCRIPTORS: SPEED   CONTROL,   ROAD TRAFFIC, LOGIC CIRCUITS, DIGITAL
CIRCUITS, CLUTCHES
IDENTIFIERS: ENGINE   SPEED   AND   CLUTCH   SYNCHRONIZING   CONTROL,
TRANSMISSION   CONTROLS,   ELECTRONIC   CONTROL   SYSTEM,   GEAR   SHIFTS,
SYNCHRONOUS CLUTCH SHAFT SPEEDS, PRESHIFT PREDICTIVE COMPUTER, DIGITAL
LOGIC CIRCUITRY
SECTION CLASS CODES: C7461, C7322
AN   ELECTRONIC CONTROL SYSTEM FOR A CLUTCH LOCATED BETWEEN AN ENGINE
AND   A VARIABLE RATIO TRANSMISSION INCLUDES MEANS TO DETECT THE SPEED
OF THE INPUT AND OUTPUT CLUTCH SHAFTS, AND TO CONTROL THE ENGINE SPEED
BEFORE   DURING GEAR SHIFTS SO THAT THE CLUTCH WILL ENGAGE AT
SYNCHRONOUS   CLUTCH SHAFT SPEEDS. A SPECIAL PRESHIFT PREDICTIVE
COMPUTER MEANS IS USED IN COMBINATION WITH SPECIAL DIGITAL LOGIC
CIRCUITRY TO INSURE RELIABLE AND OPTIMUM OPERATION

435322   C7220814
FLUIDIC GOVERNOR SYSTEM
PATENT NO.: UK   1266415   ASSIGNEES: BENDIX CORP.   FILED: 7 MARCH
1969
ORIGINAL PATENT APPL. NO.: USA   712976
PRIORITY DATE: 14 MAR 1968
8 MARCH 1972
DESCRIPTORS: SPEED CONTROL, FLUIDICS, DIGITAL CIRCUITS, CONTROLLERS
IDENTIFIERS: FLUIDIC GOVERNOR SYSTEM, CONTROLLING, FLUID PULSE
GENERATORS, TRAIN PULSES, ENGINE SPEED, FLUIDIC CIRCUITRY, FLUID PULSE
ERROR SIGNAL, FREQUENCY
SECTION CLASS CODES: C7322, C7410
DISCLOSES A SYSTEM FOR CONTROLLING THE SPEED OF AN ENGINE. IT
EMPLOYS FLUID PULSE GENERATORS PRODUCING POLSES, HAVING A FREQUENCY
REPRESENTING THE SPEED OF THE ENGINE, AND FURTHER TRAIN PULSES FOR
REPRESENTING A DESIRED ENGINE SPEED VALUE. THE PULSE TRAINS ARE FED TO
FLUIDIC CIRCUITRY PRODUCING A FLUID PULSE ERROR SIGNAL HAVING A
FREQUENCY WHICH VARIES WITH THE ERROR SIGNAL AND WHICH CONTROL THE
ENGINE TO REDUCE THE ERROR

424526   C7219772
PRACTICAL APPLICATION OF COMPUTERS TO AUTOMOTIVE ENGINE BEARING
DESIGN
   SPIKES, R.H., PIRAULT, J.P.
   ERD ENG. MATER. AND DES. (GB)   VOL.15, NO.6   493-6   JUNE 1972
CODEN: EMADA3
   DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, COMPUTER-AIDED
DESIGN
   IDENTIFIERS: COMPUTERS,   AUTOMOTIVE   ENGINE   BEARING   DESIGN,
LUBRICATION, HYDRODYNAMIC PERFORMANCE OF THE OIL, BIG END BEARING
   SECTION CLASS CODES: C8829
   DESCRIBES HOW THE COMPUTER MAY BE USED IN CALCULATIONS CONCERNING
THE LUBRICATION SYSTEM AND HYDRODYNAMIC PERFORMANCE OF THE OIL IN A
BIG END BEARING   (7 REFS)

424278   A7248636, B7225961, C7219502
   PROCEEDINGS OF THE 17TH INTERNATIONAL ISA AEROSPACE INSTRUMENTATION
SYMPOSIUM
   ; INSTRUMENT SOC. AMERICA
   STD BOOK NO.: 87664 154 0
   1971
   10-12 MAY 1971   INSTRUMENT SOC. AMERICA   LAS VEGAS, NEV., USA
   PUBL: INSTRUMENT SOC. AMERICA   PITSBURGH, PA., USA
   DESCRIPTORS: SPACE VEHICLES INSTRUMENTATION, COMPUTER APPLICATIONS,
AEROSPACE   INSTRUMENTATION,   AEROSPACE APPLICATIONS OF COMPUTERS,
AEROSPACE
   IDENTIFIERS: AEROSPACE INSTRUMENTATION, ENVIRONMENTAL INSTRUMENTATI-
ON, AEROSPACE COMPUTER APPLICATIONS, ENGINE TESTING, OPTICAL
INSTRUMENTATION,   WIND   TUNNEL,   TELEMETRY,   SURFACE   VEHICLE
INSTRUMENTATION, DATA PROCESSING, DISPLAY, MEASUREMENT TECHNIQUES, IN
FLIGHT INSTRUMENTATION
   SECTION CLASS CODES: A2050, B3620, C8812
   THE FOLLOWING TOPICS WERE DEALT WITH: ENVIRONMENTAL INSTRUMENTATION:
AEROSPACE COMPUTER APPLICATIONS; IN-FLIGHT INSTRUMENTATION; ENGINE
TESTING; OPTICAL INSTRUMENTATION; WIND TUNNEL; TELEMETRY; SURFACE
VEHICLE INSTRUMENTATION; DATA PROCESSING AND DISPLAY; ADVANCES IN
MEASUREMENT TECHNIQUES AND DEVICES. INDIVIDUAL PAPERS WITHIN THE
SUBJECT SCOPE OF THIS JOURNAL WILL BE ABSTRACTED IN THIS OR A
SUBSEQUENT ISSUE

421274   17230095
  DIGITAL DATA REDUCTION METHODS FOR AIRCRAFT ENGINE NOISE ANALYSIS
  MCNEILL, H.   : RENSSELAER POLYTECH. INST. CONNECTICUT, HARTFORD,
USA
  SOUND AND VIBR. (USA)   VOL.6, NO.4   26-9   APRIL 1972   CODEN:
SOVIAJ
  DESCRIPTORS: ACOUSTIC NOISE, SONIC MEASUREMENTS
  IDENTIFIERS: DIGITAL DATA REDUCTION METHODS, AIRCRAFT ENGINE NOISE
ANALYSIS, ANALOGUE ELECTRONIC ANALYSERS, ANALYSIS TIME, FAN NOISE
SPECTRUM
  SECTION CLASS CODES: B3810
  DIGITAL DATA REDUCTION METHODS FOR ANALYZING AIRCRAFT ENGINE NOISE
CHARACTERISTICS ARE DISCUSSED. THE APPROACH IS SUPERIOR TO THOSE
EMPLOYING ANALOG ELECTRONIC ANALYZERS BECAUSE OF REDUCED ANALYSIS
TIME, LOWER COST, AND IMPROVED INFORMATION EXCHANGE RESULTING FROM THE
ANALYTICAL TECHNIQUE STANDARDIZATION THAT IS POSSIBLE. ANALYSIS OF A
FAN NOISE SPECTRUM EXEMPLIFIES APPLICATION OF THE DIGITAL DATA
REDUCTION METHOD   (2 REFS)

410013   C7217153
  COMPUTER AIDED DESIGN OF CONTROL AND GAS EXCHANGE IN INTERNAL
COMBUSTION ENGINE IN DIALOGUE MADE WITH A VIDEO DISPLAY
  PAPE2, ST., BARTSCH, H.J.
  SYRBE, M.
  ; INTERKAMA
  STD BOOK NO.: 3 486 33571 5
  INTERKAMA 5TH INTERNATIONAL CONGRESS WITH EXHIBITION FOR INSTRUMENTS
AND AUTOMATION   163-7   1972
  18-23 OCT 1971   INTERKAMA   DUSSELDORF, GERMANY
  PUBL: R. OLDENBOURG VERLAG   MUNICH, GERMANY
  DESCRIPTORS: COMPUTER AIDED DESIGN, HEAT ENGINES, ENGINEERING
APPLICATIONS OF COMPUTERS, DISPLAY SYSTEMS, MAN-MACHINE SYSTEMS
  IDENTIFIERS: FOUR STROKE ENGINE, MAN MACHINE DIALOGUE, COMPUTER
AIDED DESIGN, CONTROL AND GAS EXCHANGE, INTERNAL COMBUSTION, ENGINE
CONTROL, OPTIMIZATION, VIDEO DISPLAY
  SECTION CLASS CODES: C8629, C7551, C8825
  LANGUAGE: GERMAN
  THE PUTTING INTO EFFECT OF THE DEMANDS MADE ON THE DESIGNER OF
ENGINES DEPENDS ON MANY PARAMETERS. AN OPTIMUM SOLUTION CAN ONLY BE
FOUND IN CONNECTION WITH EXPERIMENTS. THIS IN TURN DEMANDS TIME AND
MONEY. IN ORDER TO FACILITATE FINDING THE SOLUTION, TWO PROGRAMS WERE
SET UP WITH WHICH ENGINE CONTROL AND GAS EXCHANGE OF THE FOUR-STROKE
ENGINE IS OPTIMIZED BY MEANS OF A VIDEO DISPLAY CONNECTED WITH THE
COMPUTER. THE MAN-MACHINE DIALOGUE IS SHOWN IN DETAIL ON THE BASIS OF
DATA FOR EXAMPLES.   (4 REFS)

409795   A7248636, B7225961, C7216905
   PROCEEDINGS OF THE 17TH INTERNATIONAL ISA AEROSPACE INSTRUMENTATION
SYMPOSIUM
   ; INSTRUMENT SOC. AMERICA
   STD BOOK NO.: 87664 154 0
   1971
   10-12 MAY 1971   INSTRUMENT SOC. AMERICA   LAS VEGAS, NEV., USA
   PUBL: INSTRUMENT SOC. AMERICA PITSBURGH, PA., USA
   DESCRIPTORS: SPACE VEHICLES INSTRUMENTATION, COMPUTER APPLICATIONS,
AEROSPACE   INSTRUMENTATION,   AEROSPACE APPLICATIONS OF COMPUTERS,
AEROSPACE
   IDENTIFIERS: AEROSPACE INSTRUMENTATION, ENVIRONMENTAL INSTRUMENTATI-
ON,   AEROSPACE   COMPUTER   APPLICATIONS,   ENGINE TESTING, OPTICAL
INSTRUMENTATION,   WIND   TUNNEL,   TELEMETRY,   SURFACE   VEHICLE
INSTRUMENTATION, DATA PROCESSING, DISPLAY, MEASUREMENT TECHNIQUES, IN
FLIGHT INSTRUMENTATION
   SECTION CLASS CODES: A2050, B3620, C8812
   THE FOLLOWING TOPICS WERE DEALT WITH: ENVIRONMENTAL INSTRUMENTATION:
AEROSPACE COMPUTER APPLICATIONS; IN-FLIGHT INSTRUMENTATION; ENGINE
TESTING; OPTICAL INSTRUMENTATION; WIND TUNNEL: TELEMETRY; SURFACE
VEHICLE INSTRUMENTATION; DATA PROCESSING AND DISPLAY: ADVANCES IN
MEASUREMENT TECHNIQUES AND DEVICES. INDIVIDUAL PAPERS WITHIN THE
SUBJECT SCOPE OF THIS JOURNAL WILL BE ABSTRACTED IN THIS OR A
SUBSEQUENT ISSUE

396731   C7213411
   AIRCRAFT JET ENGINE FUEL CONTROL
   PATENT NO.: UK   1256666   ASSIGNEES: BODENSEEWERK GERATE-TECHNIK
GMBH   FILED: 19 MARCH 1970
   ORIGINAl PATENT APPL. NO.: GERMANY   P1920002.3
   PRIORITY DATE: 19 APR 1969
   15 DEC. 1971
   DESCRIPTORS: HEAT SYSTEMS, TURBINES, FLOW CONTROL, TEMPERATURE
CONTROL, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS, AIRCRAFT,
AEROSPACE APPLICATIONS OF COMPUTERS
   IDENTIFIERS: AIRCRAFT JET ENGINE FUEL CONTROL, THROTTLE LEVER,
:TRIMMING: LEVER, ADJUSTING, FUEL SUPPLY, REGULATE TURBINE GAS
TEMPERATURE, COMPUTER, ENGINE OPERATING CONDITIONS, AIRCRAFT ALTITUDE
DEVIATIONS
   SECTION CLASS CODES: C7551, C7323, C8825, C7326
   DISCLOSES A FUEL CONTROL SYSTEM UTILISING A MAIN THROTTLE LEVER,
ALSO A :TRIMMING: LEVER FOR ADJUSTING THE FUEL SUPPLY TO REGULATE
TURBINE GAS TEMPERATURE. THE OPTIMUM TEMPERATURE OR TRIMMING LEVER
SETTING IS DETERMINED BY A COMPUTER ACCOUNTING FOR ENGINE OPERATING
CONDITIONS AND AIRCRAFT ALTITUDE DEVIATIONS FROM THE OPTIMUM, BEING
INDICATED BY LAMPS, ETC

385127   C7211409
   ENGINE FUEL CONTROL
   PATENT NO.: UK   1258392   ASSIGNEES: ROLLS-ROYCE LTD.   FILED: 23
DEC. 1968
   ORIGINAL PATENT APPL. NO.: UK   59029/67
   PRIORITY DATE: 29 DEC 1967
   30 DEC. 1971
   DESCRIPTORS: AIRCRAFT, AEROSPACE CONTROL, AEROSPACE APPLICATIONS OF
COMPUTERS, CLOSED LOOP SYSTEMS, MINIMIZATION, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS
   IDENTIFIERS: ENGINE   FUEL CONTROL, COMPUTER, MINIMISING, FUEL
REQUIREMENT, AIRCRAFT, CLOSED LOOP SYSTEM
   SECTION CLASS CODES: C7575, C8829, C8825
   DESCRIBES A SYSTEM USING A COMPUTER ETC., FOR MINIMISING TOTAL FUEL
REQUIREMENT OF ENGINES LOCATED TOWARDS OPPOSITE SIDES OF AN AIRCRAFT
ETC. COURSE DIRECTION AND SPEED ARE MAINTAINED BY A CLOSED-LOOP SYSTEM
ADAPTED FOR VARYING RESPECTIVE ENGINE FUEL SUPPLIES IN OPPOSITE SENSES
TO   OBTAIN   MAXIMUM   OVERALL   EFFICIENCY ETC., AS INDICATED BY
ACCELERATION OF THE AIRCRAFT, PARTICULARLY IN A CASE WHERE THE ENGINE
EFFICIENCIES ARE DIFFERENT

375770   C7210355
   THE CDC STAR-100 A LARGE SCALE NETWORK ORIENTED COMPUTER SYSTEM
   HOLLAND, S.A., PURCELL, C.J.   ; CONTROL DATA CORP., MINNEAPOLIS,
MINN., USA
   ; IEEE
   5TH ANNUAL 1971 IEEE INTERNATIONAL COMPUTER SOCIETY CONFERENCE ON
HARDWARE, SOFTWARE, FIRMWARE AND TRADE-OFFS (DIGESTS)   55-6   1971
   22-24 SEP 1971   IEEE   BOSTON, MASS., USA
   PUBL: IEEE   NEW YORK, USA
   DESCRIPTORS: GENERAL PURPOSE COMPUTERS
   IDENTIFIERS: CDC STAR 100, NETWORK ORIENTED COMPUTER SYSTEM,
COMPUTER SYSTEM, COMPUTING ENGINE, DISTRIBUTED NETWORK, ARCHITECTURAL
   SECTION CLASS CODES: C9610
   AN EXTREMELY LARGE AND POWERFUL COMPUTER SYSTEM HAS BEEN DEVELOPED
BY CONTROL DATA CORPORATION (THE STAR-100) FOR THE USE AS A LARGE
COMPUTING ENGINE AT THE CENTER OF A DISTRIBUTED NETWORK OF OTHER
COMPUTING SYSTEMS. THIS PAPER OUTLINES SOME OF THE SALIENT FEATURES OF
THE STAR-100 SYSTEM AS WELL AS SOME CONSIDERATIONS FOR THE USE OF THIS
SYSTEM IN ITS INTENDED ENVIRONMENT

364901   C7207316
  RECENT DEVELOPMENT OF SHIPBOARD SUPER-AUTOMATION
  IMAMURA, H.
  JARU (JAPAN) VOL.4, NO.4   38-48   1971
  DESCRIPTORS: MARINE SYSTEMS, CONTROL ENGINEERING APPLICATION OF
COMPUTERS
  IDENTIFIERS: GENERAL PURPOSE OFFICER OR CREW PLAN, AUTOMATIC
NAVIGATION SYSTEMS, ENGINE PLANT CONTROL SYSTEM, SHIPBOARD AUTOMATION,
ELECTRONIC COMPUTER
  SECTION CLASS CODES: C7574, C8825
  STUDIES OF SHIPBOARD AUTOMATION BEGAN IN JAPAN AHEAD OF THE REST OF
THE WORLD, AND 10 YEARS AGO THE WORLD:S FIRST AUTOMATED SHIP, THE
:KINKASAN MARU: WAS COMPLETED. SINCE THEN, TECHNOLOGICAL IMPROVEMENTS
HAVE BEEN MADE ON SHIPBOARD AUTOMATION. THE :SEIKO MARU: THAT COULD
SUCCEED IN THE DEVELOPMENT OF HIGHLY CENTRALIZED CONTROL SYSTEM OF A
SHIP WAS COMPLETED IN 1970 AS THE FIRST SUPER- AUTOMATED SHIP IN THE
WORLD, BY TAKING FULL ADVANTAGES OF ELECTRONIC COMPUTER ON BOARD. IT
IS BELIEVED THAT THE FRUITFUL RESULTS OBTAINED FROM THE TECHNICAL
INNOVATION WILL BE WIDELY REFLECTED UPON THREE OBJECTIVES I.E., THE
MECHANIZATION OF HUMAN TASKS ON BOARD SHIP, THE IMPROVEMENT OF SHIP
SAFETY, AND ECONOMICAL OPERATION OF SHIPBOARD WORKS WHICH UNDOUBTEDLY
WILL BRING ABOUT THE PROSPERITY OF THE FUTURE SHIPPING CIRCLES

364832   C7207245
  MACE APPLIED TO TWO CLOSED LOOP CONTROL DDC SYSTEMS
  ST. JOHNSTON, A.D., ST. JOHNSTON, A.
  INSTRUM. PRACT. (GB)   VOL, 26 NO. 1   36-9   JAN. 1972   CODEN:
INPAAI
  DESCRIPTORS: SUPERVISORY AND EXECUTIVE PROGRAMS, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS, CLOSED LOOP SYSTEMS, DIRECT DIGITAL CONTROL
  IDENTIFIERS: MACE,   CLOSED LOOP, DDC SYSTEMS, MASTER CONTROL
EXECUTIVE, CHEMICAL PLANT, INTERNAL COMBUSTION ENGINE
  SECTION CLASS CODES: C7563, C8825, C8829, C8370
  DESCRIBES THE APPLICATION OF A MASTER CONTROL EXECUTIVE TO THE
CONTROL SYSTEMS OF A CHEMICAL PLANT AND THAT OF AN INTERNAL COMBUSTION
ENGINE TEST BED. BOTH SYSTEMS BEING D.D.C

355027   C7205722
  HISTORY AND APPLICATIONS OF COMPUTERS
  ALLEN, M.W.
  KARBOWIAK, A.F., HURY, R.M.
  STD BOOK NO.: 0 471 45853 8
  INFORMATION, COMPUTERS, MACHINES, AND MAN   51-7   1971
  PUBL: WILEY   LONDON, ENGLAND
  DESCRIPTORS: DIGITAL COMPUTERS, ANALOGUE COMPUTERS
  IDENTIFIERS: ANALOGUE AND DIGITAL COMPUTERS, SLIDE RULE, HISTORY OF
COMPUTERS, ARITHOMETER, JACQUARD LOOM PUNCHED CARD SYSTEM, DIFFERENCE
ENGINE, ENIAC, EDVAC, APPLICATIONS OF COMPUTERS
  SECTION CLASS CODES: C8000, C8800

346618   C7204938
REQUIREMENTS FOR DIGITAL COMPUTER SIMULATION OF GAS TURBINE
PROPULSION SYSTEM PERFORMANCE PHASE 1: STEADY-STATE AND TRANSIENT
ENGINE PERFORMANCE SIMULATION. FINAL REPORT, 15 JUL. 1969-30 JUN. 1970
     HUTCHESON, L., ARMSTRONG, W.C., COOPER, C.B.
     REPORT   NO.: AEDC-TR-71-24   ISSUED BY ARO INC., ARNOLD AIR FORCE
STATION, TENN., USA
     USGRDR NO.: AD-720803
     CONTRACT NO.: F40600-71-C-0002
     MARCH 1971
     DESCRIPTORS: SIMULATION,   HEAT   ENGINES,   TURBINES,   ENGINEERING
APPLICATIONS OF COMPUTERS
     IDENTIFIERS: STEADY STATE PERFORMANCES, OFF LINE RESULTS, ON LINE
RESULTS, DIGITAL COMPUTER SIMULATION, GAS TURBINE ENGINE, TRANSIENT
PERFORMANCE, CORE MEMORY SIZE, THROUGHPUT TIMES, PROGRAMS, DISPLAY
REQUIREMENTS, DYNAMIC COMPRESSOR MATHEMATICAL MODELS
     SECTION CLASS CODES: C9940
     AVAILIABILITY: NTIS, SPRINGFIELD, VA. 22151, USA
     PRESENT AND NEAR-FUTURE REQUIREMENTS FOR THE ADDITION OF DIGITAL
COMPUTER SIMULATION   OF GAS TURBINE ENGINE STEADY-STATE AND TRANSIENT
PERFORMANCE TO THE PRESENT ENGINE TEST FACILITY AND PROPULSION WIND
TUNNEL FACILITY DIGITAL DATA CAPABILITY WERE DETERMINED BASED ON
INFORMATION AND GUIDANCE PROVIDED BY THE AIR FORCE AERO PROPULSION
LABORATORY AND VARIOUS GAS TURBINE ENGINE MANUFACTURERS. DURING PHASE
I OF THIS STUDY, DIGITAL COMPUTER HIGH-SPEED CORE MEMORY SIZE AND
THROUGHPUT TIMES WERE DETERMINED AND ARE PRESENTED FOR SEVERAL MODERN
STEADY- STATE AND TRANSIENT MATHEMATICAL MODEL SIMULATION PROGRAMS.
DISPLAY REQUIREMENTS WERE ALSO DETERMINED AND ARE PRESENTED FOR FULL
UTILIZATION OF THE MATHEMATICAL MODEL RESULTS, OFF-LINE AND ON-LINE
SOME PRELIMINARY RESULTS ON DYNAMIC COMPRESSOR MATHEMATICAL MODELS ARE
DISCUSSED

346189   C7204504
ANALOGUE INVESTIGATION OF THE INERTIA-COUPLED FREE-PISTON ENGINE
     MOORE, A.   : NAT. ENGNG. LAB., EAST KILBRIDE, GLASGOW, SCOTLAND
     PROC.   INST. MECH. ENG. (GB)   VOL. 185, NO. 53   725-32   1970-1
CODEN: PIMLAA
     DESCRIPTORS: MECHANICAL ENGINEERING, ENGINEERING APPLICATIONS OF
COMPUTERS, ANALOGUE COMPUTER METHODS
     IDENTIFIERS: INERTIA   COUPLED   FREE   PISTON   ENGINE,   ANALOGUE
INVESTIGATION, EQUATIONS OF MOTION, ENGINE OF PRACTICAL DIMENSIONS,
TORQUE MULTIPLY, OVERALL MECHANICAL EFFICIENCY
     SECTION CLASS CODES: C8829, C9950
     AN ENGINE IS DESCRIBED IN WHICH A FREE PISTON IS LOCATED INSIDE A
CYLINDER ASSEMBLY WHICH IS ALSO ALLOWED FREEDOM OF MOVEMENT IN THE
AXIAL DIRECTION. POWER IS TAKEN FROM THE UNIT BY COUPLING THE PISTONS
THROUGH HYDROSTATIC PUMP DIRECTLY INTO THE CYLINDER ASSEMBLY. THE
EQUATIONS OF MOTION FOR THE DEVICE ARE PRESENTED IN NON-DIMENSIONAL
FORM AND SOLVED WITH THE AID OF AN ANALOGUE COMPUTER. RESULTS ARE
PRESENTED FOR AN ENGINE OF PRACTICAL DIMENSIONS AND THE INHERENT
ABILITY OF THE SYSTEM TO TORQUE MULTIPLY IS CONFIRMED. ESTIMATES OF
OVERALL MECHANICAL EFFICIENCY ARE INCLUDED

336232   B7102663, C720166

AUTOMATIC TEST SYSTEM FOR JET ENGINE ACCESSORIES
COWLEY, R.T.   ; RCA, BURLINGTON, MASS., USA
; IEEE, REGION 6, WEMA
PAPERS PRESENTED AT THE WESTERN ELECTRONIC SHOW AND CONVENTION
21/4 6PP.   1971
  24-27 AUG 1971   IEEE, REGION 6, WEMA   SAN FRANCISCO, CALIF., USA
  PUBL: WESTERN PERIODICALS CO.   NORTH HOLLYWOOD, CALIF., USA
  DESCRIPTORS: AUTOMATIC TEST EQUIPMENT, AEROSPACE TEST FACILITIES,
COMPUTER APPLICATIONS, AEROSPACE APPLICATIONS OF COMPUTERS, AUTOMATIC
TESTING
  IDENTIFIERS: AUTOMATIC TEST SYSTEM, JET ENGINE ACCESSORIES, DESIGN,
MULTISTATION HARDWARE/COMPUTER-SOFTWARE SYSTEM, CONTROL, INFORMATION
PROCESSING PROBLEMS, AEROSPACE TEST FACILITIES, AEROSPACE APPLICATIONS
OF COMPUTERS, REAL TIME DATA ACQUISITION, AUTOMATIC CALIBRATION,
AUTOMATIC TESTING
  SECTION CLASS CODES: B3610, C8829
  THE   DESIGN   AND   DEVELOPMENT   OF   A   MULTISTATION
HARDWARE/COMPUTER-SOFTWARE SYSTEM HAS BEEN UNDERTAKEN TO AUTOMATE THE
CALIBRATION, TEST AND MAINTENANCE OF MECHANICAL ASSEMBLIES. THE SYSTEM
ATSJEA (AUTOMATIC TEST SYSTEM FOR JET ENGINE ACCESSORIES), HAS BEEN
DESIGNED AND FABRICATED USING COMMERCIAL COMPONENTS. IT WILL HANDLE A
WIDE RANGE OF REAL-TIME DATA ACQUISITION, CONTROL AND INFORMATION
PROCESSING PROBLEMS. THE FIRST APPLICATION IS TO CALIBRATE AND TEST
JET ENGINE FUEL CONTROLS. THIS PAPER PRESENTS THE SYSTEM REQUIREMENTS
AND HARDWARE/COMPUTER-SOFTWARE IMPLEMENTATION THAT WAS APPLIED TO
ACHIEVE THE SYSTEM PERFORMANCE GOALS

323668   C7124250
A GRAPHICS TECHNIQUE FOR THE DESIGN OF MULTIVARIABLE SYSTEMS
FALLSIDE, P., SERAJI, H.   ; UNIV. CAMBRIDGE, ENGLAND
; IEE
STD BOOK NO.: 0 85296045 X
4TH UKAC CONTROL CONVENTION ON MULTIVARIABLE CONTROL SYSTEM DESIGN
AND APPLICATIONS   87-92   1971
1-3 SEP 1971   IEE   MANCHESTER, ENGLAND
PUBL: IEE   LONDON, ENGLAND
DESCRIPTORS: MULTIVARIABLE   CONTROL SYSTEMS, COMPUTER AIDED DESIGN,
TURBINES
IDENTIFIERS: MULTIVARIABLE CONTROL SYSTEMS, DESIGN BY STATE FEEDBACK
, DESIGN BY OUTPUT FEEDBACK, COMPUTER AIDED DESIGN, LINEAR TIME
INVARIANT MULTIVARIABLE FEEDBACK SYSTEMS, FREQUENCY DOMAIN RESULTS,
GAS TURBINE ENGINE CONTROL, INTERACTIVE GRAPHICS TECHNIQUE, DESIGN,
STATE OR OUTPUT FEEDBACK, INCOMPLETE STATE FEEDBACK
SECTION CLASS CODES: C8825
A NEW INTERACTIVE GRAPHICS TECHNIQUE FOR THE DESIGN OF LINEAR,
TIME-INVARIANT MULTIVARIABLE FEEDBACK SYSTEMS WITH ANY NUMBER OF
INPUTS, STATES AND OUTPUTS IS DESCRIBED. THE METHOD IS BASED ON A
NUMBER OF RECENT FREQUENCY-DOMAIN RESULTS FOR FEEDBACK DESIGN TO
ACHIEVE DESIRED CLOSED-LOOP POLE POSITIONS. THESE ARE FAIRLY GENERAL
AND PRACTICAL IN THAT THEY ALLOW THE DESIGNER TO EMPLOY EITHER STATE
OR OUTPUT FEEDBACK, AND COVER THE CASE OF INCOMPLETE STATE FEEDBACK
WHERE NOT ALL THE STATES ARE ACCESSIBLE AND OF OUTPUT FEEDBACK WHERE
THERE ARE FEWER OUTPUTS THAN STATES. IN ADDITION THE DESIGNER CAN
SPECIFY THE RELATIVE TIGHTNESS OF THE FEEDBACK TO EACH INPUT AND TREAT
THE CASE OF FEEDBACK TO ONLY SOME INPUTS, INCOMPLETE INPUT FEEDBACK.
THE METHOD IS BASED ON A PROGRAM MVSD IN WHICH THE DESIGNER POSITIONS
THE CLOSED-LOOP POLES ON THE CRT DISPLAY BY MEANS OF A LIGHT-PEN. A
BRIEF DESCRIPTION IS GIVEN FIRST OF THE THEORETICAL RESULTS FOLLOWED
BY A DESCRIPTION OF THE INTERACTIVE PROCEDURE AND FINALLY A DESIGN
STUDY IS MADE OF A 2-INPUT, 2-OUTPUT, 4TH ORDER GAS-TURBINE ENGINE
CONTROL PROBLEM USING THE TECHNIQUE

322953   A7174439, B7138586, C7123574
PROCEEDINGS OF THE NATIONAL AEROSPACE ELECTRONICS CONFERENCE 1971
; IEEE, DAYTON SECTION, IEEE, AEROSPACE AND ELECTRONICS GROUP
1971
17-19   MAY   1971   IEEE, DAYTON SECTION, IEEE, AEROSPACE AND
ELECTRONICS GROUP   DAYTON, OHIO, USA
  PUBL: IEEE   NEW YORK, USA
  DESCRIPTORS: SPACE   RESEARCH,   AERODYNAMICS,   NOISE   ACOUSTIC,
CALCULATING APPARATUS, BIOPHYSICS, AEROSPACE, AIRCRAFT, ACOUSTIC NOISE
, COMPUTER APPLICATIONS, AIRCRAFT COMMUNICATION, POWER SYSTEMS,
NAVIGATION, COMPUTER ARCHITECTURE, COMMUNICATIONS SYSTEMS DATA,
  IDENTIFIERS: JET ENGINE, NOISE ABATEMENT, ENVIRONMENTAL SENSORS,
WAKE TURBULENCE, AVIONIC COMMUNICATIONS, RADIO, VISUAL, SATELLITE,
RECONNAISSANCE, NAVIGATION, SECONDARY POWER SYSTEMS, COMPUTER SYSTEMS,
TIME FREQUENCY CONCEPTS, MICROELECTRONICS, BIOCYBERNETICS
  SECTION CLASS CODES: A2050, B3600, C7576, B2634
  THE FOLLOWING TOPICS WERE DEALT WITH: JET ENGINE NOISE ABATEMENT,
ENVIRONMENTAL   SENSORS;   AIRCRAFT   WAKE   TURBULENCE;   AVIONIC
COMMUNICATIONS,   RADIO,   VISUAL,   AND   SATELLITE   SYSTEM;   AIRBORNE
RECONNAISSANCE, PHOTOGRAPHIC AND RADIOMETRIC; NAVIGATION SYSTEMS;
SECONDARY   POWER   SYSTEMS   FOR   AIRCRAFT;   COMPUTER   SYSTEMS;   TIME
FREQUENCY CONCEPTS FOR AEROSPACE UTILISATION; MICROELECTRONICS AND
DEVICES; BIOCYBERNETICS. THERE WERE 90 PARTICIPANTS FROM 2 COUNTRIES
59 PAPERS WERE PRESENTED, OF WHICH 44 ARE PUBLISHED IN FULL IN THE
PRESENT PROCEEDINGS, AND 4 AS ABSTRACTS ONLY. INDIVIDUAL PAPERS WITHIN
THE SUBJECT SCOPE OF THIS JOURNAL WILL BE ABSTRACTED IN THIS OR A
SUBSEQUENT ISSUE

322586   C7123140
DIRECT HYBRID CONTROL OF AN ENGINE USING ADAPTIVE LOGIC, ADAPTIVE
PROGRAMMING AND SELF-ORGANISING STORAGE
    CARTER, G.A., MAMDANI, E.H., EVANS, F.J.   ; QUEEN MARY COLL.,
LONDON, ENGLAND
    ; IEE
    STD BOOK NO.: 0 85296045 X
    4TH UKAC CONTROL CONVENTION ON MULTIVARIABLE CONTROL SYSTEM DESIGN
AND APPLICATIONS   93-7   1971
    1-3 SEP 1971   IEE   MANCHESTER, ENGLAND
    PUBL: IEE   LONDON, ENGLAND
    DESCRIPTORS: HEAT ENGINES, SIMULATION, HYBRID COMPUTER METHODS, SELF
ORGANIZING STORAGE, LOGIC CIRCUITS, PROGRAMMING, MULTIVARIABLE CONTROL
SYSTEM
    IDENTIFIERS: DIRECT HYBRID CONTROL, HYBRID COMPUTER SIMULATION,
MULTIVARIABLE CONTROL SYSTEMS, SELF ORGANISING STORAGE, ADAPTIVE
PROGRAMMING, SMALL GENERAL PURPOSE DIGITAL COMPUTERS, CONTROL AND
SUPERVISORY ROLE, :HEURISTIC: METHODS, SMALL MODEL STEAM ENGINE,
:EXTERNAL: COMPARATOR CIRCUITS, ADAPTIVE LOGIC ELEMENTS
    SECTION CLASS CODES: C7551, C6120, C9950, C6240
    THE MOTIVATION FOR THIS IS THE POSSIBILITY OF USING SMALL GENERAL
PURPOSE DIGITAL COMPUTERS OF LOW COST IN A CONTROL AND SUPERVISORY
ROLE ON ESSENTIAL PLANT. THE MAIN CONCERNS ARE (A) FLEXIBILITY OF THE
PROGRAM SO THAT IT CAN BE USED WITH A WIDE VARIETY OF PLANTS, AND (B)
EVENTUAL RELIABILITY AND SIMPLICITY. THIS STUDY REPRESENTS A
PRELIMINARY INVESTIGATION INTO THE FEASIBILITY AND EVOLUTION OF SUCH
AN APPROACH BASED ON :HEURISTIC: METHODS. THE REQUIRED FLEXIBILITY OF
THE PROGRAM IMPLIES THE USE OF ADAPTIVE OR :HEURISTIC: METHODS.
HOWEVER, INSTEAD OF IMPLEMENTING ANY KNOWN :LEARNING: SCHEME, THE
PROGRAM IN THIS STUDY HAS BEEN EVOLVED STARTING WITH THE SIMPLEST
SCHEME IN ORDER TO KEEP ITS COMPLEXITY TO A MINIMUM. SINCE RELIABILITY
RATHER THAN ACCURACY IS THE MAIN CONCERN, THE SYSTEM DESCRIBED IS
DESIGNED TO DEAL WITH SITUATIONS THAT ARE LIKELY TO OCCUR DURING START
UP AND ARE THOSE OCCURRING DUE TO LARGE PERTURBATIONS DURING NORMAL
OPERATION

322464   A7175048, B7139711, C7123123
PROCEEDINGS OF THE 1971 INTERSOCIETY ENERGY CONVERSION ENGINEERING
CONFERENCE
; SOC. AUTOMOTIVE ENGRS., AMERICAN CHEM. SOC., AMERICAN INST.
AERONAUTICS AND ASTRONAUTICS, AMERICAN SOC. MECH. ENGRS., IEEE,
AMERICAN INST. CHEM. ENGRS., AMERICAN NUCL. SOC., AMERICAN POWER
CONFERENCE, MARINE TECHNOLOGY SOC
  1971
  3-5 AUG. 1971   SOC. AUTOMOTIVE ENGRS., AMERICAN CHEM. SOC.,
AMERICAN INST. AERONAUTICS AND ASTRONAUTICS, AMERICAN SOC. MECH.
ENGRS., IEEE, AMERICAN INST. CHEM. ENGRS., AMERICAN NUCL. SOC.,
AMERICAN POWER CONFERENCE, MARINE TECHNOLOGY SOC   BOSTON, MASS., USA
  PUBL: SOC. AUTOMOTIVE ENGRS.   NEW YORK, USA
  DESCRIPTORS: ELECTRICITY DIRECT CONVERSION, DIRECT ENERGY CONVERSION
, POWER SYSTEMS, HEAT ENGINES
  IDENTIFIERS: AUTOMOTIVE, ENGINE, EMISSIONS, ELECTRIC VEHICLE, POWER,
SPACE FLIGHT, ENERGY CONVERSION, MEDICAL APPLICATIONS, BIOLOGICAL,
ECOLOGICAL, COMPRESSION IGNITION, RADIOISOTOPE THERMOELECTRIC
GENERATORS, UNDERWATER, SYSTEMS, METEOROLOGICAL EFFECTS, NUCLEAR,
BATTERY, THERMAL, POLLUTION, COMPUTER SIMULATION, STIRLING ENGINES,
NOISE, FUSION, HEAT, FOSSIL FUEL
  SECTION CLASS CODES: A0535, B4400, C7550, B4110
  THE FOLLOWING TOPICS WERE DEALT WITH: FUTURE POWER-GENERATOR
METHODS; ADVANCED AUTOMOTIVE ENGINE EMISSIONS; ELECTRIC VEHICLE
SYSTEMS; POWER FOR MANNED SPACE FLIGHT; ENERGY CONVERSION SYSTEMS FOR
MEDICAL APPLICATIONS; ADVANCED AUTOMOTIVE ENGINES; BIOLOGICAL AND
ECOLOGICAL EFFECTS OF EMISSIONS; ADVANCES IN COMPRESSION IGNITION
ENGINES; RADIOISOTOPES THERMOELECTRIC GENERATOR FOR ADVANCED MISSIONS;
UNDERWATER POWER SYSTEMS; METEOROLOGICAL EFFECTS OF EMISSION; NUCLEAR
POWER SYSTEMS; BATTERY DEVELOPMENTS; THERMAL POLLUTION EFFECTS; SMALL
STATIONARY POWER SOURCES; CLOSED CYCLE ENGINES; POWER SYSTEMS FOR
ADVANCED MISSIONS; SPACE POWER TECHNOLOGY; POWER SYSTEM COMPUTER
SIMULATION; STIRLING ENGINES; NOISE POLLUTION; ADVANCES IN FUSION
POWER PLANTS; HEAT ENGINE HYBRID AUTOMOTIVE POWER PLANTS; RADIOISOTOPE
THERMOELECTRIC GENERATORS TEST AND FLIGHT RESULTS; ADVANCES IN FOSSIL
FUEL POWER PLANTS; ADVANCED AUTOMOTIVE ENGINE TECHNOLOGY. 141 PAPERS
WERE PRESENTED, OF WHICH ALL ARE PUBLISHED IN FULL IN THE PRESENT
PROCEEDINGS. INDIVIDUAL PAPERS WITHIN THE SUBJECT SCOPE OF THIS
JOURNAL WILL BE ABSTRACTED IN THIS OR A SUBSEQUENT ISSUE.

320802   A7174988, B7138590
  ACOUSTICAL ENGINEERING AT JET TEST SITE
  ENVIRON. CONTROL. SAF. MANAGE. (USA)   VOL. 142, NO. 1   20-1   JULY
1971
  DESCRIPTORS: NOISE/ACOUSTIC, NOISE, AIRCRAFT, AEROSPACE TEST
FACILITIES
  IDENTIFIERS: JET PLANE ENGINE, TURBOFAN ENGINE, NOISE ATTENUATING
EQUIPMENT, ACOUSTICAL ENGINEERING, COMPUTER SYSTEM, SOUND ABSORBING
MATERIALS
  SECTION CLASS CODES: A0340, B3610
  A NEED FOR A VIBRATION FREE CONTROL AND MONITORING CENTRE IS
EMPHASISED

301526   C7119937
A GENERALIZED METHOD FOR CALCULATION AND ANALYSIS OF THE ACTUAL ICE
CYCLE WITH CONSTANT PRESSURE IN THE SCAVENGING AND EXHAUST CHAMBERS
USING A DIGITAL COMPUTER
   JANKOV, R.   ; UNIV. BEOGRADU, YUGOSLAVIA
   TEHNIKA (YUGOSLAVIA)   VOL.26, NO.4   701-16   1971   CODEN: TEHNA7
   DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, NUMERICAL
METHODS, HEAT SYSTEMS
   IDENTIFIERS: ICE CYCLE, SCAVENGING AND EXHAUST CHAMBERS, DIGITAL
COMPUTER, DIESEL ENGINES, VARIABLES PRESSURES, INTERNAL ENERGY,
DISSOCIATION AND VARIABILITY OF THE SPECIFIC HEAT, GAS COMPOSITION,
NUMERICAL METHOD, SCAVENGING CURVE, STATIONARY MODEL TEST, SCAVENGING
PROCESS, BACK FLOW OF GASES, LAWS OF COMBUSTION, HEAT TRANSFER,
LEAKAGE LOSSES AND GAS VOLUME INCREASE, DIESEL ENGINE, COMPLEX
SIMILARITY LAW
   SECTION CLASS CODES: C8829
   LANGUAGE: CROATIAN
   THE METHOD CAN BE USED FOR TWO- AND FOUR-STROKE PETROL AND DIESEL
ENGINES WITH CONSTANT PRESSURE IN SCAVENGING AND EXHAUST CHAMBERS AND
ALSO WITH VARIABLE PRESSURES IF THESE ARE KNOWN BY MEASUREMENT. FOR
CALCULATION OF THE INTERNAL ENERGY OF THE GASES IN THE CYLINDER, THE
DISSOCIATION AND VARIABILITY OF THE SPECIFIC HEAT AS A FUNCTION OF
TEMPERATURE AND GAS COMPOSITION WERE TAKEN INTO ACCOUNT. A NUMERICAL
METHOD USING THE SCAVENGING CURVE FROM A STATIONARY MODEL TEST WAS
DEVELOPED FOR CALCULATION OF THE SCAVENGING PROCESS WITH ALLOWANCE FOR
BACK FLOW OF GASES INTO THE SCAVENGING CHAMBER. THE LAWS OF
COMBUSTION, HEAT TRANSFER, LEAKAGE LOSSES AND GAS VOLUME INCREASE IN
THE CYLINDER DUE TO COMBUSTION IN THE CASE OF THE DIESEL ENGINE WERE
ALSO TAKEN INTO ACCOUNT. ALL PARTS OF THE CYCLE ARE DESCRIBED BY THE
SAME SYSTEM OF EQUATIONS WHICH ARE TRANSFORMED TO PERMIT APPLICATION
OF A COMPLEX SIMILARITY LAW   (21 REFS)

301491   C7119902
   ON LINE FOR QUICK THINKING
   ASHTON, S.
   ENGINEER SUPPL. (GB)   22-4   30 JUNE 1971   CODEN: ESRSB6
   DESCRIPTORS: PROCESS CONTROL, TABLE-TOP COMPUTERS, ON-LINE OPERATION
   IDENTIFIERS: CONTROL SYSTEMS, PROCESS CONTROL, MINI COMPUTER,
FLEXIBILITY, SOFTWARE, DATA LOGGING, ENGINE TESTING, PROCESS PLANT
MONITORING, GEARBOX TESTING, AXLE TESTING, MECHANICAL HANDLING
   SECTION CLASS CODES: C8825
   SMALL COMPUTERS HAVE OPENED THE WAY TO ON-LINE CONTROL OF MANY
PROCESSES ON THE SHOP FLOOR. THIS PAPER LOOKS AT THE LIKELY
APPLICATIONS

300794   C7119173
  THE USES OF A REAL TIME COMPUTER IN NUCLEAR ROCKET ENGINE TESTING
  HENSHALL, J.B.   ; UNIV. CALIFORNIA, LOS ALAMOS, USA
  ; AKASHI SEISAKUSHO LTD., ET AL
  PROCEEDINGS OF THE 8TH INTERNATIONAL SYMPOSIUM ON SPACE TECHNOLOGY
AND SCIENCE 121-30   1969
  25-30 AUG 1970   AKASHI SEISAKUSHU LTD., ET AL   TOKYO, JAPAN
  PUBL: AGNE PUBLISHING INC.   TOKYO, JAPAN
  DESCRIPTORS: NUCLEAR SYSTEMS, AEROSPACE CONTROL
  IDENTIFIERS: REAL TIME COMPUTER, NUCLEAR ROCKET ENGINE TESTING,
PROPULSIONS SYSTEM, NUCLEAR ENERGY
  SECTION CLASS CODES: C7575
  A PROGRAM TO DEVELOP A PROPULSION SYSTEM UTILIZING NUCLEAR ENERGY
HAS BEEN UNDERWAY FOR TEN YEARS IN THE UNITED STATES. THE PROPULSION
UNIT CONSISTS OF A SOLID REACTOR WITH THE NUCLEAR ENERGY TRANSFERRED
TO HYDROGEN PROPELLANT. THE LOW MOLECULAR WEIGHT OF HYDROGEN GIVES A
SPECIFIC IMPULSE EXCEEDING 800 SEC. IN THE TESTING PROGRAM, THE
REACTOR IS OPERATED AT TEMPERATURES AND POWER DENSITIES WHICH ARE
CLOSE TO MATERIAL LIMITS. THEREFORE IT BECOMES NECESSARY TO MONITOR,
DURING THE TEST, REACTOR AND FACILITY PERFORMANCE. THESE MONITORING
FUNCTIONS AND OTHER APPLICATIONS HAVE BEEN SOLVED BY THE USE OF A REAL
TIME DIGITAL COMPUTER. IN ADDITION, THE COMPUTER GENERATES THE TIME
PROFILES REQUIRED TO START THE REACTOR AND RELATED FACILITY SYSTEMS
AND CONTROL THEIR OPERATION DURING THE POWERED PHASE OF THE TEST.
FUTURE CONTROL USES CONTEMPLATED FOR THE COMPUTER ARE DISCUSSED

300763   C7119141
  COMPUTER CONTROL OF MARINE ENGINES (PROPULSION)
  SWITZMAN, J.
  ; SOC. ELECTRONIC AND RADIO TECHNICIANS
  PROCEEDINGS OF THE SYMPOSIUM ON MARINE ELECTRONICS   109-17   1971
  9-12 JUL 1971   SOC. ELECTRONIC AND RADIO TECHNICIANS   BRISTOL,
ENGLAND
  PUBL: SOC. ELECTRONIC AND RADIO TECHNICIANS   LONDON, ENGLAND
  DESCRIPTORS: MARINE SYSTEMS, TRANSPORTATION, CONTROL ENGINEERING
APPLICATIONS OF COMPUTERS
  IDENTIFIERS: MARINE PROPULSION ENGINES, COMPUTER CONTROL, UNATTENDED
ENGINE ROOM OPERATION, EFFECT OF FAILURES, INCREASED RESPONSIBILITY
  SECTION CLASS CODES: C7574, C8825
  WORLD WIDE GROWTH OF TRADE AND SHIPPING, TECHNICAL DEVELOPMENTS,
SHORTAGE OF SKILLED MANPOWER HAVE LED TO INCREASING INTRODUCTION OF
UNATTENDED ENGINE ROOM OPERATION AT SEA AND THE PARALLEL INTRODUCTION
OF AUTOMATION TO MAKE THIS POSSIBLE. AT THE SAME TIME THE EFFECT OF
FAILURES OF MACHINE OR MAN ARE MUCH MORE SERIOUS IN ALL ASPECTS.
REDUCTION IN ENGINE ROOM CREW, LARGER AND MORE COMPLEX MACHINERY,
NON-CONTINUOUS ATTENDANCE IN THE ENGINE ROOM PLACE AN EVEN BIGGER
RESPONSIBILITY ON THE SHIP:S CREW

290983   C7117423
A HYBRID COMPUTER ANALYSIS OF A NON-STATIONARY PROCESS
BEAUCHAMP, K.G., THOMASSON, P.G., WILLIAMSON, M.E.   ; CRANFIELD
INST. TECHNOL., ENGLAND
GLADWELL, G.M.L.
; UNIV. WATERLOO
PROCEEDINGS OF THE SYMPOSIUM ON COMPUTER-AIDED ENGINEERING   19-30
1971
11-13 MAY 1971   UNIV. WATERLOO   WATERLOO, ONTARIO, CANADA
PUBL: UNIV. WATERLOO   WATERLOO, ONTARIO, CANADA
DESCRIPTORS: HYBRID COMPUTER METHODS, AEROSPACE APPLICATIONS OF
COMPUTERS, TIME-VARYING SYSTEMS, ACOUSTIC NOISE, HEAT SYSTEMS
IDENTIFIERS: HYBRID COMPUTER ANALYSIS, NONSTATIONARY PROCESS, JET
ENGINE NOISE, SPECTRAL ANALYSIS, AIRCRAFT NOISE ABATEMENT
SECTION CLASS CODES: C8829, C9950
THE PROBLEM OF JET AIRCRAFT NOISE IS AN INCREASING ONE AND THE
DESIGN ENGINEER WILL SOON BE FACED WITH THE TASK OF LIMITING THIS TO
THE MANDATORY LEGAL REQUIREMENTS GOVERNING THE NOISE RADIATED FROM THE
AIRCRAFT IN FLIGHT. A NECESSARY PREREQUISITE IS TO UNDERSTAND MORE ABOUT
THE NATURE OF THIS NOISE. IT IS RELATIVELY EASY TO TAKE SOUND
MEASUREMENTS FROM AN AIRCRAFT SITUATED ON THE GROUND, BUT SIMILAR
MEASUREMENTS TAKEN AT GROUND LEVEL FOR AN AIRCRAFT IN FLIGHT PRESENT A
NUMBER OF DIFFICULTIES DUE TO THE COMPLEX NON-STATIONARY NATURE OF THE
RADIATED NOISE. THIS PAPER ATTEMPTS TO DESCRIBE A SPECTRAL ANALYSIS
METHOD BY WHICH THE ENGINEER CAN BE GIVEN A QUANTITATIVE DESCRIPTION
OF DETECTED NOISE VALUES SO AS TO ENABLE AN ASSESSMENT TO BE MADE OF
THE EFFECTIVENESS OF HIS PRACTICAL MEASURES IN AIRCRAFT NOISE
ABATEMENT

290849　　C7117280
　REMOTE TEST SITE COMPUTATION OF COMPLEX ENGINE INLET DYNAMIC PARAMETERS USING AN ANALOG COMPUTER
　SMITH, E.L., FLEETWOOD, P.H.　　; MCDONNELL AIRCRAFT CO., ST. LOUIS, MO., USA
　; INSTRUMENT SOC. AMERICA
　STD BOOK NO.: 87664 141 9
　ADVANCES IN INSTRUMENTATION, PROCEEDINGS OF THE 25TH ANNUAL ISA CONFERENCE　647/1-9　1970
　II　　26-29 OCT 1970　INSTRUMENT SOC. AMERICA　PHILADELPHIA, PA., USA
　PUBL: INSTRUMENT SOC. AMERICA　PITTSBURGH, PA., USA
　DESCRIPTORS: AIRCRAFT
　IDENTIFIERS: REMOTE TEST SITE COMPUTATION, ANALOG COMPUTER, COMPLEX ENGINE INLET DYNAMIC PARAMETERS, INTEGRATED CIRCUIT OPERATIONAL AMPLIFIERS
　SECTION CLASS CODES: C8821
　A SYSTEM TO PROVIDE REAL TIME COMPUTATION AND DISPLAY OF COMPLEX ENGINE INLET DISTORTION PARAMETERS WHICH ARE COMPUTED FROM A LARGE NUMBER OF DYNAMIC PRESSURE DATA SIGNALS, WAS SUCCESSFULLY IMPLEMENTED, USING INTEGRATED CIRCUIT OPERATIONAL AMPLIFIERS AS THE PRIMARY ANALOG COMPUTATIONAL ELEMENTS. PRATT AND WHITNEY ENGINE PARAMETERS IN USE AT THE TIME ARE SHOWN AND HARDWARE DIAGRAMS OF THE COMPUTATIONAL CIRCUITRY ARE EXPLAINED. IT IS SHOWN HOW THE SYSTEM PROVIDED FLAGGING PULSES TO THE RAW DATA TAPES FOR SUBSEQUENT DIGITIZATION AND COMPUTER ANALYSIS OF :WORST CASE: DATA, WITH RESULTANT IMPROVEMENT IN TEST DATA AT SIGNIFICANT SAVINGS IN TIME AND MONEY

290156   C7116550
THE HOEGH PROJECT: OPERATIONAL CONTROL AND AUTOMATION ABOARD SHIP BY
COMPUTER
DRAGER, K.H.   ; DET NORSKE VERITAS, OSLO, NORWAY
: NORWEGIAN ASSOC. PROFESSIONAL ENGRS., POLYTECH. ASSOC. NORWEGIAN
ASSOC. PROFESSIONAL ENGRS., IEEE, NORWEGIAN SECTION, NORWEGIAN ASSOC.
ELECTRIC. ENGRS
ELEKTROTEK. TIDSSKR. (NORWAY)   VOL.84,   NO.8   54   6 MAY 1971
CODEN: ETTOAA
CONF: 24TH   MEETING   OF RADIOTECHNOLOGY   AND   ELECTRO—ACOUSTICS
(ABSTRACTS   ONLY   RECEIVED)   18-20 JUN 1971   NORWEGIAN ASSOC.
PROFESSIONAL   ENGRS.,   POLYTECH.   ASSOC. NORWEGIAN ASSOC. PROFESSIONAL
ENGRS.,   IEEE,   NORWEGIAN   SECTION,   NORWEGIAN   ASSOC. ELECTRIC. ENGRS
BODO, NORWAY
DESCRIPTORS: MARINE SYSTEMS, ENGINEERING APPLICATIONS OF COMPUTERS,
HEAT ENGINES, PRESSURE AND VACUUM MEASUREMENT, TEMPERATURE MEASUREMENT
, CONTROL ENGINEERING APPLICATIONS OF COMPUTERS, COMPUTER—AIDED
ANALYSIS
IDENTIFIERS: DIESEL   ENGINE INFORMATION,   PRESSURE MEASUREMENT,
TEMPERATURE   MEASUREMENT,   ENGINE CYLINDERS,   COMPUTER INSTALLATION,
AUTOMATIC   CONTROL,   SHIP:S ENGINE ROOM,   CRT DISPLAY, FAULT FINDING
ROUTINES, COMBUSTION
SECTION CLASS CODES: C7574, C8825, C8829
LANGUAGE: NORWEGIAN
A COMPUTER INSTALLATION USED FOR THE AUTOMATIC CONTROL OF A SHIP:S
ENGINE ROOM IS DESCRIBED. TWO MACHINES ARE USED, ONE FOR PERFORMING
REAL TIME TASKS, AND THE OTHER FOR DOING BATCH PROCESSING JOBS
INITIATED BY EITHER THE FIRST MACHINE OR BY THE OPERATOR. INFORMATION
ABOUT THE DIESEL ENGINES IS GIVEN ON A CRT DISPLAY AND FAULT FINDING
ROUTINES CAN BE USED. IN PARTICULAR, THE PRESSURE AND TEMPERATURE IN
THE ENGINES CYLINDERS DURING COMBUSTION CAN BE MEASURED. THE
INSTALLATION IS ARRANGED TO BE EASILY ACCESSIBLE, AND HAS SELF
CHECKING FACILITIES. ALL THE CONTROLS AND DISPLAYS ARE ON THE ENGINE
ROOM CONTROL DESK, SO THAT CENTRAL COMMAND OF THE ENGINE ROOM IS
OBTAINED

289851   C7116222
DIGITAL ENGINE CONTROL
AVIAT. REV. (GB)   NO.26   16-17   MAY 1971
DESCRIPTORS: AEROSPACE INSTRUMENTATION, AEROSPACE CONTROL, TURBINES
IDENTIFIERS: ENGINE CONTROL EQUIPMENT, DIGITAL
SECTION CLASS CODES: C7551

289766   C7116131
  CZECH PNEUMATIC LOGIC SYSTEM
  FLUID POWER INT. (GB)   VOL. 36, NO. 422   43-5, 8   MAY 1971
CODEN: FLPIAT
  DESCRIPTORS: PNEUMATIC EQUIPMENT, LOGIC DEVICES
  IDENTIFIERS: PNEUMATIC LOGIC SYSTEM, PNEULOG, CZECHOSLOVAKIA, MARINE
ENGINE CONTROL,   SWITCHES,   ANALOGUE DIGITAL SIGNAL CONVERTERS,
TRANSDUCERS, PROGRAMMING DEVICES, ELECTROPNEUMATIC CONVERTERS
  SECTION CLASS CODES: C7461, C9240
  PNEUMATIC LOGIC SYSTEMS EMPLOYING MOVING PART ELEMENTS ARE USED
FAIRLY WIDELY IN EUROPE. THIS ARTICLE DESCRIBES TWO RECENT
APPLICATIONS OF THE PNEULOG SYSTEM DEVELOPED IN CZECHOSLOVAKIA

264830   E7120531, C7112548
  ACCELERATION PERFORMANCE ANALYSIS OF A GAS TURBINE DESTROYER ESCORT
  BODNARUK, A., RUBIS, C.J.   ; NAVAL SHIP RES. AND DEV. LAB.,
ANNAPOLIS, MD., USA
  TRANS. ASME SER. A (USA)   VOL.93, NO.1   49-56   JUNE 1971   CODEN:
JEPOA8
  DESCRIPTORS: GAS TURBINES, COMPUTER APPLICATIONS, ACCELERATION
MEASUREMENT,   ENGINEERING   APPLICATIONS   OF COMPUTERS, TURBINES,
COMPUTER-AIDED ANALYSIS
  IDENTIFIERS: DYNAMIC ACCELERATION PERFORMANCE ANALYSIS, GAS TURBINE
ENGINE, SINGLE SCREW DESTROYER ESCORT, REVERSING REDUCTION GEAR,
DIGITAL COMPUTER ANALYSIS, PROPELLER THRUST, TORQUE COEFFICIENTS, SHIP
PROPULSION, PROPULSION PLANT PARAMETERS, FUEL SCHEDULED ACCELERATION,
BASE PLUS BOOST OPERATING MODES, FUEL FLOW RATE CONTROL, FUEL RAMPS,
TIME BASES, ENGINE OVERTORQUE CONDITIONS, TRANSIENT THRUST
  SECTION CLASS CODES: B4240, C8829
  THE DYNAMIC ACCELERATION PERFORMANCE OF A SINGLE SCREW DESTROYER
ESCORT DRIVEN BY TWO FT4A-2 GAS TURBINE ENGINES THROUGH A REVERSING
REDUCTION GEAR WAS ANALYSED. THE ANALYSIS WAS CARRIED OUT ON A DIGITAL
COMPUTER USING A NEW METHOD OF A SECOND MODIFIED ADVANCE COEFFICIENT
TO REPRESENT PROPELLER THRUST AND TORQUE COEFFICIENTS. QUANTITATIVE
RESULTS FOR ALL THE MAJOR SHIP AND PROPULSION PLANT PARAMETERS ARE
GIVEN FOR THE SHIP IN A CALM SEA WITH NO TURNING MOTIONS DURING FUEL
SCHEDULED ACCELERATION IN THE BASE AND BASE-PLUS-BOOST OPERATING
MODES. CONTROL OF FUEL FLOW RATES USING FUEL RAMPS WITH VARYING TIME
BASES WAS FOUND TO BE EFFECTIVE IN LIMITING ENGINE OVERTORQUE
CONDITIONS DURING ACCELERATION. OTHER CONCLUSIONS ON TRANSIENT THRUST,
ACCELERATION TIME, AND HEAD REACH ARE ALSO PRESENTED

264820   C7112538
  METHOD FOR IGNITION SYSTEM TESTING AND SERVICING DECISIONS
    BRINEY, L.S., KAHEN, H., LEVITRE, F.J., LINVILLE, T.P., PETERSEN,
F.G., SKARSHINSKI, L., WIDMER, A.X.
    IBM TECH. DISCLOSURE BULL. (USA)   VOL.13, NO.10   3185-8   MARCH
1971   CODEN: IBMTAA
    DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, COMPUTER AIDED
ANALYSIS
    IDENTIFIERS: COMPUTER CONTROLLED AUTOMOBILE DIAGNOSTIC SYSTEM,
IGNITION SYSTEM TESTING TECHNIQUES, SERVICING DECISION, SPARK PLUGS
DIAGNOSIS, DISTRIBUTOR CAP, ROTOR, INTERNAL COMBUSTION ENGINE TESTING,
HIGH VOLTAGE PULSE GENERATION, IGNITION SECONDARY COILS, ANALOGUE
CIRCUITRY, SPARK PLUG WIRES VOLTAGE DETECTION, SPARK PLUG DISCHARGES,
SPARK PLUG FIRING POTENTIALS, SPARK LINE LENGTH AND SLOPE, DATA
SAMPLES COLLECTION
    SECTION CLASS CODES: C8829
    DESCRIBES A METHOD FOR DIAGNOSIS OF THE SPARK PLUGS, SPARK PLUG
WIRES, AND DISTRIBUTOR CAP AND ROTOR OF AN INTERNAL COMBUSTION ENGINE
WITHOUT DISASSEMBLY OR REMOVAL OF COMPONENT PARTS. THE METHOD CAN BE
IMPLEMENTED WITH A COMPUTER CONTROLLED AUTOMOBILE DIAGNOSTIC SYSTEM. A
SPECIAL APPARATUS PRODUCES A CONTROLLED HIGH-VOLTAGE PULSE, SIMILAR TO
THE USUAL PULSE FROM THE IGNITION COIL SECONDARY, WHICH IS FED TO THE
DISTRIBUTOR. THE SPECIAL APPARATUS ALSO CONTAINS DETECTORS AND OTHER
ANALOGUE CIRCUITRY USED TO DETECT VOLTAGE ON THE SPARK PLUG WIRES AND
THE END OF EACH SPARK PLUG DISCHARGE. A COMPUTER COLLECTS DATA SAMPLES
AND COMPUTES SPARK PLUG FIRING POTENTIAL, SPARK LINE LENGTH, AND SPARK
LINE SLOPE

246985   C7109087
  COMPUTER GRAPHICS APPLICATIONS
    GANDERTON, R.A.
    COMPUT. AIDED DES. (GB)   VOL.2, NO.3   49-60   1970   CODEN: CAIDA5
    DESCRIPTORS: COMPUTER GRAPHICS, ENGINEERING APPLICATIONS OF
COMPUTERS, COMPUTER-AIDED DESIGN, REVIEWS
    IDENTIFIERS: COMPUTER GRAPHICS APPLICATIONS, HARD COPY GRAPHICS,
INTERACTIVE GRAPHICS, DIESEL ENGINE PISTON DESIGN, CONCRETE COLUMN
DESIGN, BRIDGE DESIGN, RACING ROWING BOATS, MULTISPINDLE DRILLING
MACHINES, PIERCE AND BLANK TOOLS, CONTROL SYSTEMS, INTEGRATED CIRCUIT
DESIGN, INFORMATION DISPLAY, PRINTED CIRCUIT BOARD LAYOUT
    SECTION CLASS CODES: C8820
    CONSIDERS SOME OF THE COMMERCIAL APPLICATIONS OF COMPUTER GRAPHICS.
THERE ARE BASICALLY TWO FORMS GRAPHICS CAN TAKE-HARDCOPY GRAPHICS,
I.E. PLOTTERS AND DRAUGHTING MACHINES, AND C.R.T. DISPLAYS. THE FIRST
TYPE IS NOT TRULY INTERACTIVE, AND IS USED PRIMARILY TO OBTAIN
HARDCOPY OUTPUT TO THE PROBLEM INVOLVED. THE SECOND TYPE MAY OR MAY
NOT BE INTERACTIVE, AND THE LATTER CASE IS USED TO EASE OR SPEED UP
THE MAN-MACHINE INTERFACE AS WELL AS OBTAIN A VISUAL OUTPUT. THE
APPLICATIONS ARE GROUPED INTO HARDCOPY AND INTERACTIVE C.R.T.
GRAPHICS. THE LIST IS BY NO MEANS EXHAUSTIVE OF THE WORK CURRENTLY
BEING CARRIED OUT IN THE UK AND DOES NOT INCLUDE APPLICATIONS FROM
OUTSIDE THE UK

244153   B7114494
NUCLEAR ROCKET EXPERIMENTAL ENGINE TEST RESULTS
DURKEE, W.E., DABERVAL, F.B.   : AEROJET NUCLEAR SYSTEMS CO.,
SACRAMENTO, CALIF., USA
J. SPACECR. AND ROCKETS (USA)   VOL.7, NO.12   1397-402   DEC. 1970
DESCRIPTORS: AEROSPACE PROPULSION, NUCLEAR POWER
IDENTIFIERS: NUCLEAR ROCKET EXPERIMENTAL ENGINE TEST RESULTS,
XE-PRIME, COMPUTER SIMULATION, AUTOMATIC TEMPERATURE STARTUPS, HIGH
SPECIFIC IMPULSE OPERATION, FULL POWER, PERFORMANCE, THROTTLED
PRESSURE
SECTION CLASS CODES: E4620
AN EXTENSIVE SERIES OF TESTS OF A NUCLEAR ROCKET EXPERIMENTAL
ENGINE, XE-PRIME, WAS COMPLETED IN 1969. THE MAIN EMPHASIS OF THE
SERIES WAS UPON CHARACTERISTICS OF STARTING FROM VARIOUS CONDITIONS
AND UPON OPERATION OF THE TEST FACILITY UNDER NUCLEAR FIRING
CONDITIONS; HOWEVER, ENGINE PERFORMANCE AT FULL POWER AND THROTTLED
PRESSURE WERE ALSO INVESTIGATED. THIS PAPER COMPARES SELECTED STARTUP
TEST RESULTS WITH PREDICTIONS MADE BY COMPUTER SIMULATION OF THE TEST
SYSTEM, AND IT BRIEFLY DESCRIBES FULL-POWER AND HIGH-SPECIFIC-IMPULSE
OPERATION. REPRESENTATIVE STARTUP DATA ARE PRESENTED FOR AUTOMATIC
TEMPERATURE STARTUPS PERFORMED WITH INITIAL LEVELS OF 0.1 W AND 2.7
MW, INITIAL CORE TEMPERATURES OF APPROXIMATELY 250 DEGREES AND 1250
DEGREESR, AND DRUM EXPONENTIAL SET POINTS OF +11 DEGREES AND -8.5
DEGREES FROM CRITICAL. THE TEST RESULTS SHOWED THAT STARTUP CAN BE
CONTROLLED OVER A WIDE RANGE OF INITIAL CONDITIONS

240555   C7107853
FLIGHT TEST EVALUATION OF AN ADVANCED ON-BOARD JET ENGINE MONITORING
SYSTEM
ESSER, J.R.   : EMERSON ELECTRIC CO., ST. LOUIS, MO., USA
; IEEE, AEROSPACE AND ELECTRONIC SYSTEMS GROUP
RECORD OF THE SYMPOSIUM ON AUTOMATIC SUPPORT SYSTEMS FOR ADVANCED
MAINTAINABILITY   58-69   1970
19-21 OCT 1970   IEEE, AEROSPACE AND ELECTRONIC SYSTEMS GROUP   ST.
LOUIS, MO., USA
PUBL: IEEE   NEW YORK, USA
DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, REAL-TIME SYSTEMS,
AIRCRAFT, AUTOMATIC TESTING
IDENTIFIERS: FLIGHT TEST EVALUATION, JET ENGINE MONITORING SYSTEM,
REAL-TIME SYSTEM, INFLIGHT REAL-TIME JET ENGINE HEALTH ANALYSIS,
COMPUTER CONTROLLED JET ENGINE MONITORING SYSTEM
SECTION CLASS CODES: C8829
EMERSON ELECTRIC CO. DESIGNED, DEVELOPED AND FLIGHT TESTED ON-BOARD
A PAN AMERICAN WORLD AIRWAYS B707-321B AIRCRAFT AN ENGINE PERFORMANCE
MONITORING SYSTEM (EPMS). EPMS PROVIDES A MEANS OF DETERMINING THE
HEALTH OF THE OPERATING JET ENGINE ON A PROVEN TECHNICAL BASIS RATHER
THAN BY PERIODIC INSPECTION BASED ON ENGINE OPERATING TIME (TIME
COMPLIANCE). THE SYSTEM IS DESIGNED TO AUTOMATICALLY MONITOR AND
ANALYZE IN REAL TIME THE ENGINE PARAMETERS THAT ARE SENSITIVE
INDICATORS OF JET ENGINE HEALTH. ENGINE ANOMALIES CAN BE DETECTED (AND
ENGINE MAINTENANCE SCHEDULED), TEN TO TWENTY-FOUR HOURS SOONER THAN
SYSTEMS UTILIZING ON-BOARD RECORDING AND GROUND PROCESSING   (13 REFS)

240182   C7107455
  COMPUTER MODELING OF ROCKET ENGINE IGNITION TRANSIENTS
  MILLS, T.R., BREEN, B.P.
  REPORT NO.: NASA-CR-109865   ISSUED BY: DYNAMIC SCI., IRVINE,
CALIF., USA
  CONTRACT NO.: NAS7-467
  MAY 1970
  DESCRIPTORS: MODELLING, PROGRAMMING, SPACE VEHICLES
  IDENTIFIERS: COMPUTER MODELLING, ROCKET ENGINE IGNITION TRANSIENTS,
PROGRAMMING,   SPACE   VEHICLES,   TRANSIENT   PROPELLANT   FLOW,
PRESSURE/TEMPERATURE HISTORIES, ANALYTICAL TESTS, IGNITION SPIKING,
FUEL LEADS, CONTROLLED VALVE OPENING SEQUENCES, DIGITAL COMPUTER,
CHAMBER PRESSURIZATION PROGRAM, STARTING CHARACTERISTICS, MAXIMUM
PRESSURE PREDICTION, FUEL/OXIDIZER MIXTURE ENVIRONMENT
  SECTION CLASS CODES: C8340, C6120
  AVAILIABILITY: CFSTI, SPRINGFIELD, VA. 22151, USA
  A COMPUTER PROGRAM WAS WRITTEN TO DESCRIBE TRANSIENT PROPELLANT FLOW
AND THE PRESSURE/TEMPERATURE AND O/F HISTORIES WITH THE CHAMBER PRIOR
TO IGNITION. EXPERIMENTAL TESTS WERE PERFORMED WHICH CONFIRMED THE
ANALYTICAL FINDINGS. IGNITION SPIKING OCCURRED WITH FUEL LEADS AT LOW
FUEL TEMPERATURE, AND EVEN AT HIGH FUEL TEMPERATURES WITH LONG VACUUM
LEADS; WHILE SPIKING WAS REDUCED BY CONTROLLED VALVE OPENING SEQUENCES
AT NOMINAL TEMPERATURES. THE ANALYTICAL STUDY RESULTED IN A PROPELLANT
TRANSIENT FLOW DIGITAL COMPUTER PROGRAM AND A CHAMBER PRESSURIZATION
TRANSIENT DIGITAL COMPUTER PROGRAM WHICH WAS USED TO OBTAIN THE ENGINE
STARTING CHARACTERISTICS. THE DATA FROM THE PRESSURIZATION PROGRAM IS
USED TO PREDICT MAXIMUM PRESSURES POSSIBLE FROM THE TRANSIENT CHAMBER
FUEL/OXIDIZER MIXTURE ENVIRONMENT

239401   C7106650
  TURBOPROP FUEL CONTROL FOR USE WITH CONTAMINATED OR VARIED FUELS
  FREDLAKE, J.J., KECK, M.F., SCHWENT, G.V.
  PATENT NO.: USA   3514949   ASSIGNEES: US NAVY   FILED: 18 JUNE 1968
  ORIGINAL PATENT APPL. NO.: USA   737958
  2 JUNE 1970
  DESCRIPTORS: HEAT ENGINES, FLOW CONTROL, TURBINES
  IDENTIFIERS: FUEL FLOW CONTROL, TURBOPROP ENGINE, ENGINE POWER
CONTROL SYSTEM, CONSTANT SPEED PROPELLER GOVERNOR, CONTAMINATED OR
VARIED FUELS, COMPUTER SECTION OF ENGINE POWER CONTROL SYSTEM, ENGINE
OIL WORKING MEDIA, CORRECT TORQUE, CORRECTED SPEED
  SECTION CLASS CODES: C7551, C7326
  AN ENGINE POWER CONTROL SYSTEM FOR A TURBO-PROP ENGINE EQUIPPED WITH
A CONSTANT SPEED PROPELLER GOVERNOR IS PROVIDED WITH MEANS TO
MANIPULATE FUEL FLOW IN RESPONSE TO THE CORRECT TORQUE AND CORRECTED
SPEED OF THE ENGINE. THE COMPUTER SECTION OF THE ENGINE POWER CONTROL
SYSTEM USES ENGINE OIL AS THE WORKING MEDIA. THESE FEATURES ENABLE
CONTAMINATED FUEL, OR FUELS OF VARYING QUALITY TO BE USED, WITHOUT
REQUIRING FILTRATION OR COMPENSATING ADJUSTMENTS TO THE CONTROL SYSTEM

239290   C7106538
PLUIDIC   DIGITAL   CONTROL   APPARATUS   HAVING   MULTI-PHASE   CONTROL
FREQUENCY
    EASTMAN, J.M.
    PATENT   NO.:   USA   3532081   ASSIGNERS: BENDIX CORP.   FILED: 14
MARCH 1968
    ORIGINAL PATENT APPL. NO.: USA   712976
    6 OCT. 1970
    DESCRIPTORS: FLUIDICS, DIGITAL CONTROL
    IDENTIFIERS: DIGITAL CONTROL, FLUIDIC, MULTIPHASE, CONTROL FREQUENCY
, ENGINE GOVERNOR, PULSE GENERATOR, SPEED ERROR, BEAT FREQUENCY
    SECTION CLASS CODES: C7463
    REFERS   TO   AN   ENGINE   GOVERNOR   APPARATUS HAVING A REFERENCE SPEED
VARIABLE   FREQUENCY   FLUID PULSE GENERATOR AND AN ENGINE SPEED VARIABLE
FREQUENCY   FLUID   PULSE GENERATOR, ONE OF WHICH GENERATES A FOUR PHASE
FLUID   PULSE   OUTPUT   AGAINST   WHICH   THE   OTHER FLUID PULSE GENERATOR
OUTPUT   IS COMPARED. THE REFERENCE SPEED AND ENGINE SPEED FLUID PULSES
PROVIDE   A   CONTROL   INPUT   TO   A   PLURALITY OF PULSE OPERATED FLUIDIC
DEVICES   WHICH   RESPOND   TO   THE   OUTPUTS   OF   THE   TWO   GENERATORS IN
ACCORDANCE   WITH   A   SYNCHRONIZATION   OF THE PULSE OUTPUT OF THE OTHER
GENERATOR   WITH   THE   FOUR PHASE PULSE OUTPUT OF THE ONE GENERATOR. THE
DIRECTION   OF   ENGINE   SPEED   ERROR   IS   ESTABLISHED   BY   THE ORDER OF
SYNCHRONIZATION   OF THE FOUR PHASE PULSE OUTPUT AND THE COMPARED PULSE
OUTPUT.   THE   MAGNITUDE   OF   THE   SPEED   ERROR   IS   ESTABLISHED BY THE
FREQUENCY   AT   WHICH   THE   PULSES   SYNCHRONIZE.   A CONTROL FLUID PULSE
OUTPUT   AT   THIS   SYNCHRONIZATION   OR :BEAT: FREQUENCY IS GENERATED BY
EITHER   OF TWO FLUIDIC DEVICES ONE OF WHICH IS CONNECTED TO RESPOND TO
THE FOUR PULSE OUTPUTS IN A FIRST SEQUENTIAL ORDER REPRESENTING ENGINE
OVERSPEED AND   THE OTHER OF WHICH IS CONNECTED TO RESPOND TO THE FOUR
PULSE   OUTPUTS   IN   A   SECOND   SEQUENTIAL   ORDER   REPRESENTING   ENGINE
UNDERSPEED.   THE   ENGINE FUEL FLOW RATE IS CAUSED TO STEP UP OR DOWN IN
SMALL INCREMENTS WITH THE CONTROL FLUID PULSES. AN ANALOG PROPORTIONAL
GOVERNING ACTION IS ADDED TO THIS DIGITAL GOVERNING ACTION

227927   C7104841
SPACECRAFT CONTROL
REPORT NO.: UNNUMBERED   ISSUED BY: CALIFORNIA INST. TECHNOL.,
PASADENA, USA
31 DEC. 1969
DESCRIPTORS: AEROSPACE CONTROL, ELECTRIC SENSING DEVICES, ELECTRICAL
CONTROL EQUIPMENT, STABILITY, SPACE VEHICLE
IDENTIFIERS: SPACECRAFT CONTROL, DIGITAL SUN SENSOR, GRAY CODED
DIGITAL SIGNAL, THRUST VECTOR CONTROL ANALYSIS, SOLAR ELECTRIC ION
ENGINE, TORQUE, RATE INFORMATION, POSITION ERROR, FILTERING TECHNIQUES
INVESTIGATION, ELECTROMAGNETIC ACCELEROMETER, EVALUATION, STABILITY,
THERMAL STERILIZATION CAPABILITIES
SECTION CLASS CODES: C7576, C7421
AVAILABILITY: CFSTI, SPRINGFIELD, VA. 22151, USA
A DIGITAL SUN SENSOR IS DESCRIBED THAT USES A LINE IMAGE OF THE SUN
ON A DIGITAL DETECTOR TO PROVIDE THE SUN ANGLE IN TERMS OF A
GRAY-CODED DIGITAL SIGNAL. A SINGLE-AXIS BREADBOARD DESIGN HAVING A
5-DEGREE FIELD-OF-VIEW HAD AN OUTPUT OF AN 8-BIT DIGITAL WORD. DYNAMIC
ANALYSIS OF THRUST VECTOR CONTROL FOR A SOLAR- ELECTRIC ION-ENGINE
PROPELLED SPACECRAFT REVEALED THAT THE CONTROL TORQUE MUST BE LARGER
THAN THE TORQUE GENERATED BY THE TRANSLATION OF THE ENGINE ARRAY IN
ORDER TO INSURE STABILITY. A TECHNIQUE FOR DERIVING RATE INFORMATION
HAS BEEN DEVELOPED AND APPLIED TO PRODUCE A SIGNAL THAT IS
PROPORTIONAL TO THE POSITION ERROR. IT WAS DEMONSTRATED THAT
SEQUENTIAL FILTERING TECHNIQUES MAY BE USED FOR INVESTING OR SELECTING
CONTROL SYSTEM CONFIGURATIONS THROUGH TRADE-OFF ANALYSES. AN
ELECTROMAGNETIC ACCELEROMETER WAS EVALUATED FOR STABILITY, THERMAL
STERILIZATION CAPABILITIES, PERFORMANCE, AND SHOCK RESISTANCE

215920   C713406
BEA ENGINE OVERHAUL REWORK SCHEDULING AT HEATHROW AIRPORT
FRY, M.
; BRITISH COMPUTER SOC
DATAWARE: DATA CAPTURE TODAY   9   1970
14-15 APR 1970   BRITISH COMPUTER SOC   HULL, YORKS, ENGLAND
PUBL: BRITISH COMPUTER SOC.   LONDON, ENGLAND
DESCRIPTORS: ADMINISTRATIVE DATA PROCESSING, AIRCRAFT, AEROSPACE
APPLICATIONS OF COMPUTERS, MAINTENANCE ENGINEERING
SECTION CLASS CODES: C8640
EXTENDED ABSTRACT ONLY GIVEN, SUBSTANTIALLY AS FOLLOWS: THE REWORK
SCHEDULING SYSTEM IS DESIGNED TO PRODUCE DAILY WORK SCHEDULES AND
DAILY PROGRESS LISTS WHICH THE MEN ON THE SHOP FLOOR FOLLOW TO REPAIR
COMPONENTS IN PRIORITY ORDER TO MEET THE TARGET DATES. THIS ENABLES
BEA:S HOLDINGS OF SPARE ENGINES AND COMPONENTS TO BE CONSIDERABLY
REDUCED. A DESCRIPTION OF THE ENGINE OVERHAUL REWORK SCHEDULING SYSTEM
OUTLINE, ITS ADVANTAGES AND WORKING ARE PRESENTED IN THE PAPER

215391   C712833
THE DESIGN OF A DIGITAL THREE-TERM CONTROLLER AS A TURBOJET ENGINE
SPEED GOVERNOR USING DIGITAL SIMULATION METHODS. I. DIGITAL SIMULATION
OF THE DYNAMIC BEHAVIOUR OF A TWO-SPOOL TURBOJET ENGINE. II. A DIGITAL
THREE-TERM CONTROLLER AS A TURBOJET ENGINE SPEED GOVERNOR
    COTTINGTEN, R.V.
    REPORT   NO.: ARC-30103   ISSUED   BY: NAT. GAS TURBINE ESTAB.,
FARNBOROUGH, ENGLAND
    1970
    DESCRIPTORS: HEAT   ENGINES,   SPEED   CONTROL,   AEROSPACE CONTROL,
SIMULATION, CONTROL SYSTEM SYNTHESIS, THREE-TERM CONTROL, DIGITAL
CONTROL
    SECTION CLASS CODES: C7551, C7575, C6210, C7322, C6120
    AVAILIABILITY: CFSTI, SPRINGFIELD, VA. 22151, USA
    THE DYNAMIC BEHAVIOR OF A TWO-SPOOL TURBOJET ENGINE CAN BE DEFINED
MATHEMATICALLY AND THUS SIMULATED IN A GENERAL PURPOSE DIGITAL
COMPUTER.   THE   TECHNIQUE IS DESCRIBED TOGETHER WITH A BRIEF STATEMENT
OF THE MATHEMATICAL THEORY. COMPARISON IS MADE BETWEEN THE BEHAVIOR OF
A REAL ENGINE AND THAT OBTAINED FROM ITS DIGITAL SIMULATION, AND, IN
GENERAL,   GOOD   AGREEMENT IS FOUND. A BRIEF DISCUSSION OF THE
COMPARATIVE MERITS OF DIGITAL AND ANALOG SIMULATION IS ALSO PRESENTED.
A DIGITAL THREE-TERM CONTROLLER AS A TURBOJET ENGINE ROTOR SPEED
GOVERNOR WAS INVESTIGATED ON A TWO-SHAFT TURBOJET. THE CONTROLLER
LOGIC WAS PROGRAMMED INTO A SPECIAL PURPOSE DIGITAL COMPUTER ON-LINE
TO THE ENGINE. A NOVEL WAY OF APPLYING THE MODEL REFERENCE ADAPTATION
TECHNIQUE WAS USED TO OPTIMIZE CONTROLLER GAIN SETTINGS OFF-LINE USING
A DIGITAL SIMULATION FOR STEADY STATE AND TRANSIENT ENGINE BEHAVIOR.
THE RESULTS FROM THE ENGINE TEST AND THE DIGITAL SIMULATION ARE
PRESENTED

210910   C711133
    ENGINE CONTROL BY DIGITAL COMPUTER
    INDIAN AND E.ENG.   VOL. 112, NO. 4   249   APRIL 1970
    DESCRIPTORS: AEROSPACE APPLICATIONS OF COMPUTERS, DIRECT DIGITAL
CONTROL, ON LINE OPERATION
    SECTION CLASS CODES: C7575, C8824
    THE OLYMPUS 593 FOR THE CONCORDE SUPERSONIC AIRLINER HAS A FULLY
TRANSISTORIZED ANALOGUE CONTROL SYSTEM THAT IS AMONG THE MOST ADVANCED
IN THE WORLD. THE NEXT STAGE IN ENGINE CONTROL TECHNOLOGY IS LIKELY TO
BE THE INTRODUCTION OF DIGITAL CONTROL SYSTEMS, WHICH DEVELOPMENT IS
DISCUSSED

188203   C7018688
MATHEMATICAL   MODEL OF AN INTERNAL COMBUSTION ENGINE AND DYNAMOMETER
TEST RIG
    MONK, J., COMFORT, J.   ; UNIV. WARWICK, ENGLAND
    MEAS. AND CONTROL (GB)   VOL. 3, NO. 6   T93-100   JUNE 1970
    DESCRIPTORS: MODELLING, HEAT SYSTEMS, ANALOGUE COMPUTER METHODS,
SIMULATION
    SECTION CLASS CODES: C6120, C7551
    AN   ELECTRICAL   CIRCUIT MODEL AND AN ANALOG COMPUTER SIMULATION HAVE
BEEN   DEVELOPED TO REPRESENT THE DYNAMIC BEHAVIOUR OF AN IC ENGINE AND
EDDY   CURRENT DYNAMOMETER SYSTEM. VARIOUS REFINEMENTS TO THE MODEL ARE
INTRODUCED   AND   ITS   PERFORMANCE   IS   COMPARED WITH THAT OF THE REAL
SYSTEM USING PSEUDO-RANDOM BINARY SEQUENCE AND SINEWAVE TESTING
TECHNIQUES. A BRIEF DESCRIPTION OF THE NECESSARY INSTRUMENTATION AND
INTERFACING IS INCLUDED

175723   B7032322, C7017222
ELECTRONIC COMPUTERS, SIMULATORS AND TRAINING AIDS FOR SHIP-BORNE
EQUIPMENT
    TRANI, I.
    ALTA FREQUENZA (ITALY)   VOL.74, NO.SUPP.5   86-91   MAY 1970
    DESCRIPTORS: SHIPS, COMPUTER APPLICATION, ENGINEERING APPLICATIONS
OF COMPUTERS, SIMULATION, MARINE SYSTEMS
    SECTION CLASS CODES: B2740, C7574, B2619, C8829
    LANGUAGE: ITALIAN
    MODERN   ADVANCES IN SHIPBUILDING PRACTICE, PARTICULARLY THE INCREASE
IN SIZE AND THE INTRODUCTION OF CONTAINER SHIPS AND BULK CARRIERS,
CALL INCREASINGLY FOR AUTOMATION OF ENGINE CONTROL, NAVIGATION,
GUIDANCE AND CARGO HANDLING. DIGITAL AND ANALOG COMPUTERS AND DATA
PROCESSING FACILITIES ARE UTILIZED, WITH TRANSDUCERS AT THE PHYSICAL
INTERFACES. COMPUTERS ARE USED IN SHIP DESIGN, FOR MODELLING AND
OPTIMIZATION OF ENGINE OPERATION AND CONTROL. SIMULATORS PLAY AN
IMPORTANT PART IN ON-SHORE TRAINING OF CREWS

170777   C7018030
STUDY OF INDUCER LOAD AND STRESS (INTERIM REPORT 15 FEB 1968-15 OCT 1968)
BARTEN, H.J., COONS, L.L., DAVIS, R.F.
REPORT   NO.: NASA-CR-72514   ISSUED BY: PRATT AND WHITNEY AIRCRAFT, WEST PALM BEACH, FLA., USA
    CONTRACT NO.: NAS3-11216
    2 APRIL 1969
    DESCRIPTORS: HEAT SYSTEMS, ENGINEERING APPLICATIONS OF COMPUTER, COMPUTER-AIDED DESIGN
    SECTION CLASS CODES: C8829
    AVAILIABILITY: CFSTI, SPRINGFIELD, VA. 22151, USA
    A PROGRAM OF ANALYSIS, DESIGN, FABRICATION, AND TESTING IS BEING CONDUCTED TO DEVELOP COMPUTER PROGRAMS FOR PREDICTING ROCKET ENGINE TURBO-PUMP INDUCER HYDRODYNAMIC LOADING STRESS MAGNITUDE AND DISTRIBUTION, AND VIBRATION CHARACTERISTICS. THIS REPORT COVERS THE ANALYSIS AND DESIGN PORTION OF THE PROGRAM. METHODS OF PREDICTING BLADE LOADING STRESS, AND VIBRATION CHARACTERISTICS WERE SELECTED FROM A LITERATURE SEARCH AND USED AS A BASIS FOR THE COMPUTER PROGRAMS. A TEST INDUCER WAS DESIGNED REPRESENTATIVE OF TYPICAL ROCKET ENGINE INDUCERS AND INSTRUMENTATION WAS SELECTED TO PROVIDE MEASUREMENTS OF BLADE SURFACE PRESSURE AND STRESSES FOR CORRELATION WITH THE PREDICTION SYSTEM

161350   C7015407
    DIGITAL COMPUTER SIMULATION OF A DIESEL FUEL INJECTION
    DUBE, J.P., GOYAL, M.R.   ; GOVERNMENT ENGNG. COLL., REWA, INDIA
    J. INSTN. ENGRS. (INDIA) MECH. ENGNG. DIV.   VOL.50, NO.5, PT.ME3 132-48   JAN. 1970
    DESCRIPTORS: MECHANICAL ENGINEERING, ENGINEERING APPLICATIONS OF COMPUTERS, HEAT SYSTEMS, SIMULATION
    SECTION CLASS CODES: C8829, C7551
    THE PAPER PRESENTS A DETAILED ANALYSIS OF A DIESEL ENGINE FUEL INJECTION SYSTEM WHICH GIVES A PILOT INJECTION AND A MAIN INJECTION, USING A SINGLE PLUNGER HAVING TWO GROOVES TO GIVE STEPPED INJECTION THROUGH A SINGLE MULTI-HOLE, CLOSED NOZZLE. THE CALCULATION FOR SUCH AN INJECTION SYSTEM HAS BEEN PROGRAMMED FOR A DIGITAL COMPUTER. FINITE DIFFERENCE METHOD HAS BEEN USED FOR STEP BY STEP SOLUTION OF THE EQUATIONS AT EACH INTERVAL OF TIME. THE RESULTS PRESENTED WERE OBTAINED FOR A SET OF DATA TO SHOW THE EFFECT OF VARIOUS PUMP PARAMETERS ON THE DISCHARGE CHARACTERISTICS OF THE INJECTION SYSTEM DESIGN DATA   (10 REFS)

161327   C7015384
DETERMINATION OF THE COMBUSTION LAW OF AN INTERNAL COMBUSTION ENGINE
BY MEANS OF DIGITAL COMPUTERS USING THE INDICATED DIAGRAM
   APOSTOLESCU, M., GRUNWALD, B., TARAZA, D.
   BUL. INST. POLITEH. BUCCURESTI (ROMANIA)   VOL.31, NO.4   105-14
JULY 1969
   DESCRIPTORS: ENGINEERING APPLICATIONS OF COMPUTERS, HEAT SYSTEMS,
FLOWCHARTING
   SECTION CLASS CODES: C8829
   LANGUAGE: ROMANIAN
   THE AUTHORS PRESENT A METHOD TAKING INTO CONSIDERATION THE THERMAL
DISCONTINUITIES OF THE GAS MIXTURE, THE DISSOCIATION OF GAS, FUEL
ATOMIZATION AND HEAT EXCHANGE WITH THE WALLS. IN ORDER TO SOLVE THE
EQUATION OBTAINED WHICH SPECIFIES THE LAW OF COMBUSTION THE AUTHORS
SUGGEST THE RUNGE-KUTTA SECOND-ORDER METHOD, PRESENTING THE FLOW CHART
OF THE CALCULATION PROGRAM ELABORATED FOR A DIGITAL COMPUTER

146232   C0011424
ANALOG COMPUTER CONTROL SYSTEMS FOR THE GROUND TESTING OF NUCLEAR
ROCKET ENGINE COMPONENTS
   LANGILL, A.W.   ; PROCESS SYSTEMS INSTRUMENTATION, SACRAMENTO,
CALIF., USA
   ; INSTRUMENT SOC. AMERICA
   PROCEDINGS OF THE 23RD ANNUAL ISA CONFERENCE, ADVANCES IN
INTRUMENTATION   10PP.   1968
   1   28-31 OCT 1968   INSTRUMENT SOC. AMERICA   NEW YORK, USA
   PUBL: INSTRUMENT SOC. AMERICA   PITTSBURGH, PA., USA
   DESCRIPTORS: NUCLEAR SYSTEMS, ON-LINE OPERATION, AUTOMATIC TESTING,
ANALOGUE COMPUTER METHODS, ENGINEERING APPLICATIONS OF COMPUTERS
   SECTION CLASS CODES: C8829
   DESCRIBES THE APPLICATION OF THE LARGE-SCALE GENERAL-PURPOSE ANALOG
COMPUTER FOR THE DESIGN OF CONTROL SYSTEMS USED IN THE NON-NUCLEAR
TESTING OF NUCLEAR ROCKET ENGINE COMPONENTS AND SUB-SYSTEMS. FURTHER,
THE APPLICATION OF ON-LINE ANALOG COMPUTER CONTROL OF GROUND TEST
FACILITIES IS INDICATED. IN THIS CONTEXT, THE ON-LINE COMPUTER (EAI
PC-12) IS EMPLOYED IN CONJUNCTION WITH HIGH-SPEED SERVO SUB-SYSTEMS TO
(1) GENERATE ALL REQUIRED FORCING FUNCTIONS, (2) PROVIDE SWITCHING AND
MALFUNCTION LOGIC SHUTDOWN COMMANDS, AND (3) PERFORM THE FUNCTIONS OF
AN OVERALL SYSTEMS SUPERVISOR

132623   C709787
DYNAMIC MODELLING OF GAS TURBINE PERFORMANCE
SARAVANAMUTTOO, H.I.H., FAWKE, A.J.
; IEE, CONTROL AND AUTOMATION DIV., INSITUTE OF MEASUREMENT AND
CONTROL
INDUSTRIAL APPLICATIONS OF DYNAMIC MODELLING   133-41   1969
16-18 SEP 1969   IEE, CONTROL AND AUTOMATION DIV., INSITUTE OF
MEASUREMENT AND CONTROL   DURHAM, ENGLAND
PUBL: INSTITUTION OF ELECTRICAL ENGINEERS   LONDON
DESCRIPTORS: ANALOGUE COMPUTER METHODS, SIMULATION, AEROSPACE
APPLICATIONS OF COMPUTERS, HEAT SYSTEMS
SECTION CLASS CODES: C8829
METHODS FOR DYNAMIC MODELLING OF GAS TURBINE PERFORMANCE HAS BEEN
DEVELOPED FOR BOTH ANALOGUE AND DIGITAL COMPUTERS. THE PROBLEM IS
APPROACHED FROM THE VIEWPOINT OF THE THERMODYNAMICIST, USING THE BASIC
INFORMATION REQUIRED FOR STEADY STATE PERFORMANCE CALCULATIONS. BOTH
ANALOGUE AND DIGITAL SIMULATION METHODS HAVE PROVED TO BE
SATISFACTORY, AND GOOD AGREEMENT WITH ENGINE TESTS HAS BEEN OBTAINED.
THIS PAPER DISCUSSES THE SIMULATION OF THE SIMPLE TURBOJET ENGINE, AND
THE METHODS DESCRIBED ARE CURRENTLY BEING USED TO SIMULATE THE
PERFORMANCE OF MORE COMPLEX TWO-SPOOL AND THREE- SPOOL UNITS. THE
COMPUTER REQUIREMENTS ARE MODEST AND WELL WITHIN THE SCOPE OF
REASONABLY EQUIPPED COMPUTER LABORATORIES

114174   C706317
CALCULATION OF DIESEL ENGINES WORKING PROCESSES, AND THE APPLICATION
OF DIGITAL COMPUTERS FOR SUCH CALCULATIONS
KALMAR, I.
WISS. Z. TECH. HOCHSCH. OTTO VON GUERICKE MAGDEBURG (GERMANY)
VOL.12, NO.4   483-91   1968
DESCRIPTORS: HEAT SYST., COMP. AIDED DESIGN, ENG. APPLIC. COMP.,
DESIGN AND CALC. AIDS
SECTION CLASS CODES: C8829
LANGUAGE: GERMAN
THE NUMBER OF EXPERIMENTS DURING DEVELOPMENT OF AN ENGINE CAN BE
REDUCED BY THE STUDY OF DIESEL ENGINE INDICATOR DIAGRAMS. WHEN THE
COMPUTATION METHOD IS LAID DOWN, COMPUTATION BY HAND IS COMPARED WITH
THAT BY A COMPUTER. THE VIBE COMBUSTION LAW AND THE HEAT TRANSFER
EQUATIONS BY PFLAUME WERE USED WITH THE COMPUTER. THE MATCHING OF THE
COMPUTATION RESULT TO AN ENGINE INDICATOR DIAGRAM, AND THE EFFECT OF A
SINGLE PARAMETER COMPUTED BY THE PROGRAM SO DETERMINED, ARE GIVEN   (
11 REFS)

114172   C706315
COMPUTER MODEL FOR CALCULATING THE BURNT CHARGE VOLUME AND THE
SURFACE AREA OF THE PROPAGATING FLAME IN A SPARK IGNITION ENGINE
   SOMAYAJULU, K.D.S.R., SUBRAMANYAM, J.K.
   J. INSTN. ENGRS. (INDIA), MECH. ENGNG. DIV.   VOL. 49, NO. 11, PT.
ME6   298-302   JULY 1969
   DESCRIPTORS: ENG. APPLIC. COMP., HEAT SYSTEMS
   SECTION CLASS CODES: C8829
   IN   A   COMBUSTION CHAMBER DESIGN, THE VOLUME OF THE CHARGE BURNT AND
THE SURFACE AREA OF THE FLAME FRONT AS THE FLAME PROPAGATES ARE
IMPORTANT CONSIDERATIONS. A METHOD OF CALCULATION TO BE SOLVED ON A
DIGITAL COMPUTER IS DESCRIBED. THE METHOD ENVISAGES DETERMINING THE
VOLUME COMMON TO A SPHERE AND THE COMBUSTION CHAMBER. THE POINTS ON
THE BOUNDARY OF THE COMBUSTION CHAMBER ARE GIVEN IN CARTESIAN
COORDINATES ABOUT A CONVENIENT ORIGIN. THE POINTS ARE CONVERTED INTO
SPHERICAL COORDINATES WITH THE SPARK PLUG LOCATION AS THE ORIGIN. A
SYSTEMATIC PROCEDURE FINDS THE RADIUS AS THETA AND PHI ARE CHANGED AND
COMPUTES BY SUMMATION, THE VOLUME AND SURFACE AREA FOR SEVERAL FLAME
RADII. LIMITATIONS AND ADVANTAGES OF THE METHOD ARE DESCRIBED

67901   B6921645, C699490
   COMPUTER DATA PROCESSING TO COMPUTE NERVA TRANSFER FUNCTIONS
   BEVENSON, H.
   ; ATOMIC ENERGY OF CANADA LTD U.S.A.E.C. NASA
   IEEE TRANS. NUCLEAR SCI. (USA)   VOL.S-16, NO.1   207-9   FEB. 1969
   CONF: 15TH NUCLEAR SCIENCE SYMPOSIUM 23-25 OCT 1968 ATOMIC
ENERGY OF CANADA LTD U.S.A.E.C. NASA   MONTREAL, CANADA
   DESCRIPTORS: AEROSPACE PROPULSION, COMPUTER APPLICATIONS, NUCLEAR
REACTORS,   AEROSPACE   APPLICATIONS   OF   COMPUTERS,   ENGINEERING
APPLICATIONS OF COMPUTERS
   SECTION CLASS CODES: B3630, C8829
   THIS PAPER DESCRIBES THE COMPUTER DATA-PROCESSING METHODS THAT HAVE
BEEN DEVELOPED TO PERMIT TOTAL DATA ANALYSIS COMPLETION WITHIN A 72-HR
PERIOD. TO ACHIEVE THIS GOAL, IT WAS NECESSARY TO ESTABLISH EFFICIENT
AND FLEXIBLE PROGRAMMING METHODS AND TO ENSURE THAT THE DATA ARE VALID
WHEN THE TESTS ARE CONDUCTED. BECAUSE INTERPRETATION IS ESSENTIAL, A
WELL PLANNED SYSTEMATIC APPROACH TO VERIFICATION AND SIMULATION WAS
INTRODUCED EARLY IN THE PROGRAM TO STUDY AND INTERPRET ANOMALIES THAT
COULD OCCUR IN THE DATA

65082   C6911088
   SIMPLIFIED SIMULATION OF ENGINE DYNAMICS
   STRAUBINGER, A.
   LUFTFAHRTTECHN. RAUMFAHRTTECH. (GERMANY)   VOL.15, NO.1   1-5   JAN.
1969
   DESCRIPTORS: SIMULATION,   ANALOGUE   COMPUTERS,   ENGINEERING
APPLICATIONS OF COMPUTERS
   SECTION CLASS CODES: C8829, C9950
   LANGUAGE: GERMAN
   THERE ARE THREE METHODS WHICH CAN BE USED TO SIMULATE ENGINE
DYNAMICS ON ANALOG COMPUTERS WITH ADEQUATE ACCURACY. IT DEPENDS ON THE
PURPOSE OF THE INVESTIGATION, THE COMPUTER CAPACITY AND THE TYPE OF
THE AVAILABLE ENGINE DATA, WHICH OF THE THREE METHODS IS TO BE USED IN
A GIVEN CASE

37716   P6912430, C694132
SOME CONSIDERATIONS ON THE POSSIBILITY OF THE ADAPTION OF MARINE
ELECTRICAL PROPULSION TO REMOTE CONTROL OR PROGRAMMED SYSTEM CONTROL
RAVENNA, L.
MARELLI (ITALY)   VOL.42, NO.7-12   7-28   DEC. 1968
DESCRIPTORS: PROPULSION, COMPUTER APPLICATIONS, MOTORS, SHIPS,
MARINE SYSTEMS
SECTION CLASS CODES: B4610, C7574
LANGUAGE: ITALIAN
AN HISTORICAL ACCOUNT IS GIVEN OF EARLY SYSTEMS OF DIESEL- ELECTRIC
PROPULSION, WITH PARTICULAR REFERENCE TO THE (ITALIAN) VESSELS SCILLA
AND CARIDDI. THE APPLICATION OF ELECTRIC PROPULSION TO DIFFERENT
CLASSES OF VESSEL IS CONSIDERED, TOGETHER WITH A DETAILED
INVESTIGATION OF THE ALTERNATIVE FORMS OF PRIME MOVER, ELECTRIC
CONVERSION AND PROPULSION MOTOR. INFORMATION ON RELEVANT COSTS IS
PRESENTED, AND THE ARTICLE CONCLUDES WITH A DETAILED ACCOUNT OF TWO
RECENT MARINE INSTALLATIONS WHICH HAVE INCORPORATED COMPUTER CONTROL
FOR SOME OF THE ROUTINE ENGINE ROOM OPERATIONS

User 244   Date:03/25/76   Time:06:51:15   File:14

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Set Items Description
  1    64 VOLTAGE
  2   990 SPEED
  3     3 RPM
  4  1054 1-3/OR
  5    35 REGULATOR
  6    20 GOVERNOR
  7  4182 CONTROL
  8  4208 5-7/OR
  9   828 ENGINE
 10   203 GENERATOR
 11    14 ROTATING MACHINERY
 12     2 ALTERNATING CURRENT
 13  1030 9-12/OR
 14    51 SWITCHING
 15     0 PROPORTIONAL BAND
 16    25 PROPORTIONAL
 17     0 BANG BANG
 18     2 BANG (W) BANG
 19     0 PROPOTIONAL (W) BAND
 20    78 14-19/OR
 21     1 4 AND 8 AND 13 AND 20
 22    11 4 AND 8 AND 13
 23  1209 COMPUTER
 24   252 DIGITAL
 25     0 MICROPROCESSOR
 26     0 MICRO PROCESSOR
 27     0 MICRO (W) PROCESSOR
 28    34 MINICOMPUTER
 29  1387 23-28/OR
 30    41 13 AND 29
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Print 22/5/1-11
Print 30/5/1-41

Search Time: 16.10   Prts.: 52   Descs.: 19

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4.5

2.8 2.5

3.2 2.2

3.6

4.0 2.0

1.1

1.8

1.25 1.4 1.6

MICROCOPY RESOLUTION TEST CHART

36495   D7506320
DESIGN OF DIGITAL ACTUATORS (PNEUMATIC DRIVES EXAMPLES)
USAMOV, KH.G.
VESTN. MASHINOSTR. (USSR)   NO.11   29-32 1974   CODEN: VMASAV
TRANS OF: RUSS. ENG. J. (GB)   VOL.54, NO.11   32-4   1974   CODEN:
REWJA3
   DESCRIPTORS: ACTUATORS, DESIGN, PNEUMATIC CONTROL EQUIPMENT
   IDENTIFIERS: SPRING TENSIONING, DESIGN, DIGITAL ACTUATORS,
PNEUMATICALLY ACTUATED DRIVES, VARIABLE SPEED REGULATOR, DIESEL ENGINE
, CENTRIFUGAL SWITCH, AUTOMATIC SWITCHING SYSTEMS, DIESEL ELECTRIC
LOCOMOTIVES, CONTROLLER, POSITIONERS
   SECTION CLASS CODES: D2450
   (4 REFS)

28761   D7506126
(DIESEL) ENGINE TEST BED MODEL FOR DYNAMIC CONTROL STUDIES
AL-BERMANI, S.A., GRAVESTOCK, R.E.   ; QUEEN MARY COLL., LONDON,
ENGLAND
J. AUTOMOT. ENG. (GB)   VOL.6, NO.1   10-15   FEB. 1975   CODEN:
JAUEA9
   DESCRIPTORS: DIESEL ENGINES, TEST FACILITIES, DYNAMICS, TORQUE
   IDENTIFIERS: DYNAMIC CONTROL, ANALOGUE COMPUTER MODEL, DIESEL ENGINE
, EDDY CURRENT DYNAMOMETER TEST BED, STEADY STATE, DYNAMIC TORQUE
FUNCTIONS, SPEED CONTROLLER, TRANSFER FUNCTION, THROTTLE ACTUATOR
   SECTION CLASS CODES: D5410, D1370
   (6 REFS)

25013   D7502378
TORSIONAL STABILITY ANALYSIS OF A GAS-TURBINE POWERED HELICOPTER
DRIVE SYSTEM
DARLOW, M.S., VANCE, J.M.   ; MECH. TECHNOL. INC., LATHAM, N.Y., USA
TRANS. ASME SER. A (USA)   VOL.96, NO.4   335-41   OCT. 1974
CODEN: JEPOA8
   DESCRIPTORS: HELICOPTERS, TORSION, STABILITY, DRIVES, GAS TURBINES
   IDENTIFIERS: TORSIONAL STABILITY ANALYSIS, CLOSED LOOP DYNAMIC
SYSTEM, TRANSPORT HELICOPTER SPEED GOVERNOR, GAS TURBINE ENGINE, DRIVE
TRAIN, NONLINEAR COUPLING, VIBRATIONS, ROTOR, EXCITATION, TIME
RESPONSE, FREQUENCY
   SECTION CLASS CODES: D6610, D5510, D5420
   (9 REFS)

23110   D7500475
WHAT:S NEW IN MOTORCYCLE ENGINEERING
COVINGTON, J.
AUTOMOT. ENG. (USA)   VOL.82, NO.9   37-43   SEPT. 1974   CODEN:
AVEGBI
DESCRIPTORS: DESIGN, SAFETY, POLLUTION, INTERNAL COMBUSTION ENGINES,
MOTOR VEHICLE BRAKES, MOTOR VEHICLE SUSPENSION
IDENTIFIERS: WOBBLE, ANTI LOCK BRAKES, MOTORCYCLE TECHNOLOGY, ENGINE
EFFICIENCY, OUTPUT, BRAKING, SAFETY FACTORS, SUSPENSION SYSTEMS, NOISE
, EMISSIONS CONTROL, DESIGN, AUTOMOTIVE APPLICATIONS, COMPUTER,
PREDICT, SPEED/TORQUE CHARACTERISTICS, AUTOMATED DESIGN
SECTION CLASS CODES: D6290, D5410, D1340

21808   D7406802
IMPROVED WEAR AND DEPOSIT CONTROL IN MEDIUM SPEED MARINE DIESEL
ENGINES (WITH ENGINE OIL DEVELOPMENT)
VAN DER HORST, G.W., POLMAN, J., SUNDERMEIJER, J.J.H.   ; CHEVRON
CENTRAL LAB., ROTTERDAM, NETHERLANDS
STD BOOK NO.: 9 900976 37 3
EUROPORT 73 CONFERENCE PROCEEDINGS: MARINE DIESEL ENGINES   1-12
1974
15 NOV. 1973   AMSTERDAM, NETHERLANDS
PUBL: INST. MARINE ENGRS.   LONDON, ENGLAND
DESCRIPTORS: MARINE ENGINES, DIESEL ENGINES, WEAR, OIL
IDENTIFIERS: WEAR, DEPOSIT CONTROL, MEDIUM SPEED MARINE DIESEL
ENGINES, ENGINE OILS, LABORATORY BENCH TESTS, OXIDATION, THERMAL
STABILITY, CORROSION PROTECTION, WATER TOLERANCE
SECTION CLASS CODES: D5410, D3650, D3690
(2 REFS)

21800   D7406794
TURBOCHARGING OF SMALL (DIESEL) ENGINES
GOODLET, I.W.   ; HOLSET ENGNG. CO. LTD., HUDDERSFIELD, ENGLAND
PROC. INST. MECH. ENG. (GB)   VOL. 188 NO.3   77-87   1974   CODEN:
PIMLAA
DESCRIPTORS: DIESEL ENGINES, TURBOCHARGERS, INTERNAL COMBUSTION
ENGINE PERFORMANCE
IDENTIFIERS: LOST WAX CAST ROTORS, SMALL DIESEL ENGINES,
TURBOCHARGING, ADOPTION, RADIAL FLOW TURBINES, COMPONENT EFFICIENCIES,
BEARING, SEAL DESIGN PROBLEMS, VANE VIBRATION, MANUFACTURING METHODS,
CONTROL SYSTEMS, DEMANDS, VARIABLE SPEED ENGINES
SECTION CLASS CODES: D5410
(8 REFS)

14190   D7406696
OPERATION   AND   CONTROL   OF   INDUSTRIAL   TURBINES   (E.G.   ELECTRIC
GENERATOR DRIVES)
  WILSON, W.B. ; GENERAL ELECTRIC CO., SCHENECTADY, N.Y., USA
  POWER ENG. (USA) VOL.78, NO.2   42-5   FEB. 1974
  DESCRIPTORS: STEAM   TURBINES,   STEAM-ELECTRIC   POWER   GENERATION,
VELOCITY CONTROL, ELECTRIC VARIABLES CONTROL
  IDENTIFIERS: CONTROL,   INDUSTRIAL   TURBINES,   OPERATION,   COSTS,
ELECTRIC GENERATOR DRIVES, STEAM TURBINE, STEP LOAD CHANGE, SPEED
GOVERNOR REGULATION, CONTROL PERFORMANCE
  SECTION CLASS CODES: D5440, D8210, D2230

12911   D7405417
  PROTOTYPE OF A 100-MW, 3000 RPM GAS TURBINE SERIES FOR POWER
GENERATION
  FRIGIERI, G.P.   : FIAT, TORINO, ITALY
  : ASME
  INTERNATIONAL CONFERENCE ON GAS TURBINES (PREPRINTS)   1-9   1974
  31 MARCH - 4 APRIL 1974   ASME   ZURICH, SWITZERLAND
  PUBL: ASME   NEW YORK, USA
  DESCRIPTORS: GAS TURBINES, POWER PLANTS, CONTROL SYSTEMS
  IDENTIFIERS: PROTOTYPE, GAS TURBINE, POWER GENERATION, LARGE,
CHARACTERISTICS, PEAK LOAD, ENGINE, DESIGN, TEST PROGRAM, CONTROL
SYSTEM, PACKAGE INSTALLATION, 100 MW, 3000 RPM, BASE LOAD
  SECTION CLASS CODES: D5420, D8250

6680   D7306680
  HYBRID MODEL OF AN AUTOMATED ENGINE TEST BED
  SOLIMAN, J.I.
  J. AUTOMOT. ENG. (GB)   VOL.4, NO.5   13-18   OCT. 1973   CODEN:
JAUEA9
  DESCRIPTORS: INTERNAL COMBUSTION ENGINES, MODELLING, TEST FACILITIES
, CONTROL SYSTEMS
  IDENTIFIERS: CONTROL, HYBRID MODEL, AUTOMATED, TEST BED, SPEED,
TORQUE, INTERNAL COMBUSTION ENGINE
  SECTION CLASS CODES: D5410

5471   D7305471
  A PRELIMINARY STUDY OF THE DESIGN OF A CONTROLLER FOR AN AUTOMOTIVE
GAS TURBINE (MATHEMATICAL MODELLING)
  WINTERBONE, D.E., MUNRO, N., LOURTIE, P.M.G.   ; UNIV. MANCHESTER,
ENGLAND
  TRANS. ASME SER. A (USA)   VOL.95, NO.3   244-50   JULY 1973
CODEN: JEPOA8
  DESCRIPTORS: GAS TURBINES, CONTROLLERS
  IDENTIFIERS: DESIGN, CONTROLLER, AUTOMOTIVE GAS TURBINE, FUEL MASS
FLOW, TURBINE NOZZLE ANGLE, GAS GENERATOR SPEED, TURBINE INLET
TEMPERATURE, CONTROL SYSTEM, MATHEMATICAL MODELS
  SECTION CLASS CODES: D5420, D2410
  (10 REFS)

71   D7300071
   DEVELOPMENTS IN HIGH-VOLTAGE GENERATION AND IGNITION CONTROL (FOR
COMBUSTION ENGINES)
   RITTMANNSBERGER, N.   : ROBERT BOSCH GMBH, SCHWIEBERDINGEN, GERMANY
   ; INSTN. MECH. ENGRS
   STD BOOK NO.: 0 85298 060 4
   CONFERENCE ON AUTOMOTIVE ELECTRICAL EQUIPMENT   79-84   1973
   13-14 SEPT. 1972   INSTN. MECH. ENGRS   BRIGHTON, SUSSEX, ENGLAND
   PUBL: INSTN. MECH. ENGRS.   LONDON, ENGLAND
   DESCRIPTORS: IGNITION SYSTEMS, INTERNAL COMBUSTION ENGINES
   IDENTIFIERS: DEVELOPMENTS, IGNITION CONTROL, TRANSISTORIZED METHODS,
CONTACTLESS TRIGGER SYSTEMS, SPARK IGNITED COMBUSTION ENGINE, HIGH
VOLTAGE GENERATION, COIL IGNITION
   SECTION CLASS CODES: D2450, D5410, D5320
   (3 REFS)

39132   D7601423
THE PREDICTION OF JOURNAL LOCI IN DYNAMICALLY LOADED INTERNAL
COMBUSTION ENGINE BEARINGS
   RITCHIE, G.S.   ; MECH. ENGNG. LAB., GEC, WHETSTONE, ENGLAND
   WEAR (SWITZERLAND)   VOL.35, NO.2   291-7   DEC. 1975   CODEN:
WEARAH
   DESCRIPTORS: DIESEL ENGINES, INTERNAL COMBUSTION ENGINE COMPONENTS,
COMPUTER-AIDED DESIGN, JOURNAL BEARINGS, OPTIMISATION
   IDENTIFIERS: SEMIANALYTIC METHOD, DYNAMICALLY LOADED BEARINGS,
PREDICTION OF JOURNAL LOCI, INTERNAL COMBUSTION ENGINE BEARINGS,
DIESEL   ENGINE   BEARINGS, APPROXIMATE SOLUTION, DYNAMIC REYNOLDS
EQUATION, COMPUTER PROGRAM
   SECTION CLASS CODES: D3610, D5410
   (2 REFS)

38910   D7601201
   LATERAL VIBRATION ANALYSIS OF GENERATOR-TURBINE SHAFT SYSTEMS
   NAGAFUJI, T.   ; TOKYO SHIBAURA ELECTRIC CO. LTD., HEAVY APPARATUS
ENGNG. LAB., YOKOHAMA, JAPAN
   INT. WATER POWER AND DAM CONSTR. (GB)   VOL.27, NO.11   418-23
NOV. 1975   CODEN: IWPCDM
   DESCRIPTORS: TURBOGENERATORS, SHAFTS, VIBRATIONS
   IDENTIFIERS: TRANSIENT   RESPONSE,   LATERAL   VIBRATION   ANALYSIS,
GENERATOR TURBINE SHAFT, DESIGN, COMPUTER
   SECTION CLASS CODES: D8250, D5510, D3220
   (4 REFS)

38755   D7601046
HYBRID COMPUTER TREATMENT OF SAMPLED EXPERIMENTAL DATA FROM ROTATING
PISTON MOTORS
   CAILLIAU, R., SIERENS, R.   ; RIJKSUNIV. GENT, GENT, BELGIUM
   REV.-M (BELGIUM)   VOL.21, NO.3   251-9   SEPT. 1975   CODEN: RRRMAK
   DESCRIPTORS: INTERNAL COMBUSTION ENGINE PERFORMANCE, ENGINEERING
APPLICATIONS OF COMPUTERS, ROTARY ENGINES
   IDENTIFIERS: ENGINE   DATA   ANALYSIS,   HYBRID   COMPUTER   TREATMENT,
SAMPLED EXPERIMENTAL DATA, ROTATING PISTON MOTORS, HYBRID INSTALLATION
   SECTION CLASS CODES: D5410
   LANGUAGE: FLEMISH
   (9 REFS)

38032   D7600323
TEST ENGINES PRODUCED BY DNC (COMPUTER MACHINING CENTRE AND CONVEYOR
SYSTEM)
   ASHBURN, A.
   AM. MACH. (USA)   VOL.119, NO.19   114-16   OCT. 1975   CODEN:
AMMAAA
   DESCRIPTORS: NUMERICAL   CONTROL,   MACHINING   CENTRES,   INTERNAL
COMBUSTION ENGINES, ENGINEERING APPLICATIONS OF COMPUTERS, CONVEYORS
   IDENTIFIERS: MACHINING CENTRES, TOYOTA, DNC, CONVEYORS, COMPUTER
CONTROLLED AND MONITORED SYSTEM, ENVIRONMENTAL TESTS, ENGINE PARTS,
INTEGRATED PRODUCTION SYSTEM
   SECTION CLASS CODES: D4410, D5410, D6720

37557   D7507302
SIMULATION STUDY OF TRANSIENT PERFORMANCE MATCHING OF TURBOFAN
ENGINE USING AN ANALOGUE COMPUTER TO EVALUATE ITS USEFULNESS AS DESIGN
TOOL
    ITOH, H., ISHIGAKI, T., SAGIYA, Y.   ; RES. AND DEV. DEPT., AIRCRAFT
ENGINE DIV., ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO. LTD., TOKYO,
JAPAN
    TRANS. ASME SER. A (USA)   VOL.97, NO.3   369-74   JULY 1975
CODEN: JEPOA8
    DESCRIPTORS: TURBOFAN ENGINES, COMPUTER-AIDED DESIGN, SIMULATION
    IDENTIFIERS: ANALOGUE COMPUTER SIMULATION, TRANSIENT PERFORMANCE
MATCHING, TURBOFAN ENGINE, DESIGN TOOL, DYNAMIC RESPONSE, TRANSIENT
SPEED CONDITION
    SECTION CLASS CODES: D5420

36495   D7506320
    DESIGN OF DIGITAL ACTUATORS (PNEUMATIC DRIVES EXAMPLES)
    USAMOV, KH.G.
    VESTN. MASHINOSTR. (USSR)   NO.11   29-32   1974   CODEN: VMASAV
    TRANS OF: RUSS. ENG. J. (GB)   VOL.54, NO.11   32-4   1974   CODEN:
RENJA3
    DESCRIPTORS: ACTUATORS, DESIGN, PNEUMATIC CONTROL EQUIPMENT
    IDENTIFIERS: SPRING TENSIONING, DESIGN, DIGITAL ACTUATORS,
PNEUMATICALLY ACTUATED DRIVES, VARIABLE SPEED REGULATOR, DIESEL ENGINE
, CENTRIFUGAL SWITCH, AUTOMATIC SWITCHING SYSTEMS, DIESEL ELECTRIC
LOCOMOTIVES, CONTROLLER, POSITIONERS
    SECTION CLASS CODES: D2450
    (4 REFS)

36265   D7506090
    INDUCTION RAMMING A MOTORED HIGH-SPEED FOUR-STROKE RECIPROCATING
ENGINE-INFLUENCE OF INLET PORT PRESSURE WAVES ON VOLUMETRIC EFFICIENCY
    PROSSER, T.G.   ; KING:S COLL., UNIV. OF LONDON, LONDON, ENGLAND
    PROC. INST. MECH. ENG. (GB)   VOL.188, NO.49   577-84   1974
CODEN: PIMLAA
    DESCRIPTORS: INTERNAL COMBUSTION ENGINE PERFORMANCE
    IDENTIFIERS: MOTORED HIGH SPEED FOUR STROKE RECIPROCATING ENGINE,
INDUCTION RAMMING, INFLUENCE OF INLET PORT PRESSURE WAVES, VOLUMETRIC
EFFICIENCY, PRESSURE FLUCTUATIONS, COMPUTER PROGRAMME, METHOD OF
CHARACTERISTICS, AIRFLOW FIGURES
    SECTION CLASS CODES: D5410
    (20 REFS)

35043   D7504868
    CHRYSLER:S :ELECTRONIC: LEAN-BURN ENGINE (WITH SPARK-CONTROL
COMPUTER)
    MACH. DES. (USA)   VOL.47, NO.17   24-6   10 JULY 1975   CODEN:
MADEAP
    DESCRIPTORS: INTERNAL COMBUSTION ENGINES, ENGINEERING APPLICATIONS
OF COMPUTERS
    IDENTIFIERS: SPARK ADVANCE CONTROL, ELECTRONIC LEAN BURN ENGINE,
CHRYSLER, COMPUTER, IGNITION, CIRCUIT BOARDS
    SECTION CLASS CODES: D5410

35015   D7504840
A SIMPLE STEAM GENERATOR MODEL (DIGITAL SIMULATION)
LEITHNER, R., LINZER, V.   ; LITERATURNACHWEIS AND BEISPIELE,
STUTTGART, GERMANY
BRENNST.-WAERME-KRAFT (BWK) (GERMANY) VOL.27, NO.8   334-5   AUG.
1975   CODEN: BRWKAY
  DESCRIPTORS: BOILERS, MODELLING, SIMULATION
  IDENTIFIERS: STEAM GENERATOR MODEL, DIGITAL SIMULATION
  SECTION CLASS CODES: D5220

34396   D7504221
MEASUREMENT OF AVERAGE INDICATOR DIAGRAMS BY A MINI-COMPUTER AIDED
DATA ACQUISITION SYSTEM
KONTANI, K.
J. MECH. ENG. LAB. (JAPAN)   VOL.29, NO.3   92-108   MAY 1975
CODEN: KGKSBL
  DESCRIPTORS: INTERNAL COMBUSTION ENGINE PERFORMANCE
  IDENTIFIERS: MEASUREMENT, AVERAGED INDICATOR DIAGRAMS, MINICOMPUTER
AIDED DATA ACQUISITION SYSTEM, CONTINUOUS ENGINE CYCLES, PRESSURE,
IGNITION TIMING
  SECTION CLASS CODES: D5410
  LANGUAGE: JAPANESE
  (4 REPS)

30771   D7500596
VIBRATIONS OF ROTORS IN TURBINE UNITS WITH SHORT CIRCUIT OF THE
GENERATOR (CALCULATION)
KOSINOV, YU.P., FILIPPOV, A.P.   ; KHARKOV CENTRAL DESIGN OFFICE
POWER GENERATION INDUSTRY, ACAD. SCI., UKRAINIAN SSR
  TEPLOENERGETIKA (USSR)   VOL.21, NO.6   70-3   JUNE 1974   CODEN:
TPLOA5
  TRANS OF: THERM. ENG. (GB)   VOL.21, NO.6   97-101   1974   CODEN:
THENAD
  DESCRIPTORS: TURBOGENERATORS, VIBRATIONS, STRESSES
  IDENTIFIERS: ROTORS, TURBINE UNITS, SHORT CIRCUIT, GENERATOR,
CALCULATION, DYNAMIC STRESSES, DIGITAL COMPUTER, TORSIONAL VIBRATIONS
  SECTION CLASS CODES: D8210, D5400, D3130
  (7 REPS)

30647   D7500472
ENGINE DESIGN SERIES. III. THE CRANKSHAFT
AUTOMOT. DES. ENG. (GB)   VOL.14   22-3   APRIL 1975   CODEN: ADRGBS
  DESCRIPTORS: CRANKSHAFTS, DESIGN, INTERNAL COMBUSTION ENGINE
COMPONENTS
  IDENTIFIERS: MATERIALS, ENGINE DESIGN, CRANKSHAFT, COMPUTER ANALYSIS
, STRESSES
  SECTION CLASS CODES: D5410, D5510
  (25 REPS)

29380   D7506745
CALCULATION PROCEDURES FOR POTENTIAL AND VISCOUS FLOW SOLUTIONS FOR
ENGINE INLETS
  ALBERS, J.A., STOCKMAN, N.O.   : NASA, CLEVELAND, OHIO, USA
  TRANS. ASME SER. A (USA)   VOL.97, NO.1   1-10   JAN. 1975   CODEN:
JEPOA8
  DESCRIPTORS: AIRCRAFT ENGINES, FLOW OF GASES, VISCOUS FLOW
  IDENTIFIERS: COMPUTER PROGRAM SYSTEM, POTENTIAL, SOLUTIONS, ENGINE
INLETS, CALCULATIONS, SUBSONIC CONVENTIONAL, AIRCRAFT ENGINE NACELLES,
COMPRESSIBLE VISCOUS FLOW, DESIGN, ANALYSIS, VTOL LIFT FANS, ACOUSTIC
SPLITTERS, STOL
  SECTION CLASS CODES: D5420, D3510
  (23 REFS)

29378   D7506743
SIGMA COMPUTER-CONTROLLED MACHINE INSPECTS CYLINDER BLOCKS AT RATE
OF 35/H
  MACH. AND PROD. ENG. (GB)   VOL.126, NO.3254   365-7   16 APRIL 1975
  CODEN: MPREAU
  DESCRIPTORS: INTERNAL COMBUSTION ENGINE COMPONENTS, INSPECTION,
ENGINEERING APPLICATIONS OF COMPUTERS
  IDENTIFIERS: SIGMA 3-STATION COMPUTER CONTROLLED INSPECTION MACHINE,
CHECKING, CYLINDER BLOCKS, DIESEL ENGINES, GAUGING STATION
  SECTION CLASS CODES: D5410, D1370

28761   D7506126
  (DIESEL) ENGINE TEST BED MODEL FOR DYNAMIC CONTROL STUDIES
  AL-BERMANI, S.A., GRAVESTOCK, R.E.   : QUEEN MARY COLL., LONDON,
ENGLAND
  J. AUTOMOT. ENG. (GB)   VOL.6, NO.1   10-15   FEB. 1975   CODEN:
JAURA9
  DESCRIPTORS: DIESEL ENGINES, TEST FACILITIES, DYNAMICS, TORQUE
  IDENTIFIERS: DYNAMIC CONTROL, ANALOGUE COMPUTER MODEL, DIESEL ENGINE
, EDDY CURRENT DYNAMOMETER TEST BED, STEADY STATE, DYNAMIC TORQUE
FUNCTIONS, SPEED CONTROLLER, TRANSFER FUNCTION, THROTTLE ACTUATOR
  SECTION CLASS CODES: D5410, D1370
  (6 REFS)

24210   D7501575
NEW APPLICATIONS OF THE SPARK-EROSION TECHNIQUE TO MACHINING
JANICKE, J.   ; CHARMILLES S.A., GENEVA, SWITZERLAND
; GENERAL DELEGATION TO SCI. AND TECH. RES., ET AL
4TH JOURNEES DE PRINTEMPS DE LA MECANIQUE INDUSTRIELLE. (4TH SPRING
CONFERENCE ON INDUSTRIAL MACHINERY) 6PP.   1974
   I   22-24 APRIL 1974   GENERAL DELEGATION TO SCI. AND TECH. RES., ET
AL   PARIS, FRANCE
   PUBL: GROUPEMENT POUR L:ADVANCEMENT DE LA MECANIQUE INDUSTRIELLE
SAINT-OUEN, FRANCE
   DESCRIPTORS: ELECTRICAL DISCHARGE MACHINING, MACHINE TOOL CONTROL
   IDENTIFIERS: MINI COMPUTER, NEW APPLICATIONS, MACHINING, FULLY
AUTOMATED OPERATIONAL CONTROL, OIL, DIELECTRIC, WATER, SHORT PULSE
SPARK GENERATOR, ELECTRODE SYSTEM, NUMERICAL CONTROL
   SECTION CLASS CODES: D4450
   LANGUAGE: FRENCH

24113   D7501478
SIMILARITY PARAMETER FOR SCALING DYNAMIC (PRESSURE) INLET DISTORTION
   MOORE, M.T., LUEKE, J.E.   ; GENERAL ELECTRIC CO., CINCINNATI, OHIO,
USA
   TRANS. ASME SER. B (USA)   VOL.96, NO.3   795-800   AUG. 1974
CODEN: JEFIA8
   DESCRIPTORS: PRESSURE, AERODYNAMICS
   IDENTIFIERS: ANALOGUE FILTERING, SIMILARITY PARAMETER, SCALING
DYNAMIC INLET DISTORTION, PRESSURE, DIGITAL AVERAGING, TURBINE ENGINE,
AIRCRAFT
   SECTION CLASS CODES: D3510
   (4 REFS)

23333   D7500698
DIRECT METHOD FOR ANALYSIS OF BRANCHED TORSIONAL SYSTEMS
   SHAIKH, N.   ; MERCURY MARINE, FOND DU LAC, WIS., USA
   TRANS. ASME SER. B (USA)   VOL.96, NO.3   1006-9   AUG. 1974
CODEN: JEFIA8
   DESCRIPTORS: TORSION, ENGINES, NUMERICAL ANALYSIS
   IDENTIFIERS: DIRECT METHOD, ANALYSIS, BRANCHED TORSIONAL SYSTEMS,
TRANSFER MATRICES, VIBRATIONS, JUNCTION, NATURAL FREQUENCIES, COMPUTER
SOLUTIONS, COUPLED ENGINE INSTALLATIONS, TURBINES, RECIPROCATING,
SCREW COMPRESSORS, MARINE, AUTO DIFFERENTIALS, GEARED INSTALLATIONS,
HOLZER METHOD
   SECTION CLASS CODES: D3110
   (5 REFS)

23110   D7500475
WHAT:S NEW IN MOTORCYCLE ENGINEERING
COVINGTON, J.
AUTOMOT. ENG. (USA)   VOL.82, NO.9   37-43 SEPT. 1974   CODEN:
AVEGBI
DESCRIPTORS: DESIGN, SAFETY, POLLUTION, INTERNAL COMBUSTION ENGINES,
MOTOR VEHICLE BRAKES, MOTOR VEHICLE SUSPENSION
IDENTIFIERS: WOBBLE, ANTI LOCK BRAKES, MOTORCYCLE TECHNOLOGY, ENGINE
EFFICIENCY, OUTPUT, BRAKING, SAFETY FACTORS, SUSPENSION SYSTEMS, NOISE
, EMISSIONS CONTROL, DESIGN, AUTOMOTIVE APPLICATIONS, COMPUTER,
PREDICT, SPEED/TORQUE CHARACTERISTICS, AUTOMATED DESIGN
SECTION CLASS CODES: D6290, D5410, D1340

23055   D7500420
COMPUTER SIMULATION TUNES UP ENGINE (BLOCK MACHINING) LINE (FOR
HEAVY DUTY TRUCKS)
HAWKINS, W.A.
METALWORK. PROD. (GB)   VOL.118, NO.11   91-3   NOV. 1974   CODEN:
MWPDAW
DESCRIPTORS: SIMULATION, TRANSFER LINES, PISTON ENGINES, MACHINING,
ENGINEERING APPLICATIONS OF COMPUTERS
IDENTIFIERS: COMPUTER SIMULATION, ENGINE BLOCK, MACHINING LINE,
HEAVY DUTY TRUCK, TRANSFER LINE, BALANCING, DESIGN, IN PROCESS GAUGING
, ADJUSTMENT, AUTOMATIC, DRILLING, TAPPING, V-8 CYLINDER LINE
SECTION CLASS CODES: D5410, D4400, D6720, D1360

23053   D7500418
INTERNAL COMBUSTION ENGINE INSTRUMENTATION FOR ON-LINE COMPUTER
APPLICATIONS
CONNOR, W.A.   ; UNIV. COLL., LONDON, ENGLAND
INT. J. MECH. ENG. EDUC. (GB)   VOL.2, NO.4   1-8   OCT. 1974
CODEN: IMEEB3
DESCRIPTORS: INTERNAL COMBUSTION ENGINES, INSTRUMENTS, ENGINEERING
APPLICATIONS OF COMPUTERS, TESTING
IDENTIFIERS: ON LINE COMPUTER APPLICATIONS, INTERNAL COMBUSTION
ENGINE INSTRUMENTATION, DIGITAL, TEST RIGS, PERFORMANCE DATA
SECTION CLASS CODES: D5410, D2440, D1370
(4 REFS)

22227   D7407221
METHOD OF CHARACTERISTIC PERFORMANCE CALCULATION OF JOURNAL BEARINGS
UNDER DYNAMIC LOADING
NAKAGAWA, E.   : ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO. LTD.,
TOKYO, JAPAN
ISHIKAWAJIMA-HARIMA ENG. REV. (JAPAN)   VOL.14, NO.5   497-506
SEPT. 1974   CODEN: ISHGAV
DESCRIPTORS: JOURNAL BEARINGS, LOADING
IDENTIFIERS: CHARACTERISTIC PERFORMANCE CALCULATION, JOURNAL
BEARINGS, DYNAMIC LOADING, DIGITAL COMPUTER METHOD, FLUID FILM
PRESSURE, FORCE, FRICTION LOSSES, DIESEL ENGINE
SECTION CLASS CODES: D3610
LANGUAGE: JAPANESE
(2 REFS)

21798   D7406792
INTERNAL COMBUSTION ENGINE TESTING BY DIGITAL COMPUTERS
SOLIMAN, J.I.   ; QUEEN MARY COLL., UNIV. LONDON, ENGLAND
J. AUTOMOT. ENG. (GB)   VOL.5, NO.4   22-6   AUG. 1974   CODEN:
JAUEA9
   DESCRIPTORS: INTERNAL COMBUSTION ENGINES, TESTING, ENGINEERING
PLICATIONS OF COMPUTERS
   IDENTIFIERS: INTERNAL COMBUSTION ENGINE, TESTING, DIGITAL COMPUTERS
   SECTION CLASS CODES: D5410, D1370

21176   D7406170
THE WORLD:S LONGEST CYLINDER BLOCK (MACHINE TOOL TRANSFER) LINE IS
ON RUSSIAN FRONT
   HOLLINGUM, J.
   ENGINEER (GB)   VOL.239 NO.6184   40-1, 44   19 SEPT. 1974   CODEN:
ENGIAL
   DESCRIPTORS: TRANSFER LINES, MACHINE TOOLS, INTERNAL COMBUSTION
ENGINE COMPONENTS
   IDENTIFIERS: INGERSOLL CYLINDER BLOCK TRANSFER LINE, RUSSIAN KAMA
RIVER TRUCK PLANT, MACHINE TOOL, COMPUTER SIMULATION, REMOTE AUTOMATIC
TOOL ADJUSTMENT
   SECTION CLASS CODES: D5410, D4400

20082   D7405076
MATCHING ENGINE-GENERATOR SYSTEMS TO NUCLEAR CORE-SPRAY REQUIREMENTS
   HARTUNG, E.C.   ; GENERAL ELECTRIC CO., SAN JOSE, CALIF., USA
   POWER ENG. (USA)   VOL.78, NO.7   52-5   JULY 1974
   DESCRIPTORS: COMPUTER AIDED DESIGN, NUCLEAR POWER STATIONS, ELECTRIC
GENERATORS, DIESEL ENGINES
   IDENTIFIERS: MATCH, DESIGN, COMPUTER ANALYSIS PROGRAM, PUMP MOTORS,
COMPONENTS, GOVERNOR, EXCITATION SYSTEM, NUCLEAR CORE SPRAY, MOTOR,
DIESEL ENGINE GENERATOR SYSTEMS
   SECTION CLASS CODES: D8100, D1340

20001   D7404995
USER EXPERIENCE OF A COMPUTER BASED WATCHKEEPING AND CONTROL SYSTEM
(IN A TRAWLER)
   HATFIELD, M.
   ; INST. MARINE ENGRS., NAUTICAL INST
   STD BOOK NO.: 0 900976 40 3
   PRACTICAL EXPERIENCE WITH SHIPBOARD AUTOMATION   12-21   1974
   6 MARCH 1974   INST. MARINE ENGRS., NAUTICAL INST   ENGLAND
   PUBL: MARINE MEDIA MANAGEMENT   LONDON, ENGLAND
   DESCRIPTORS: CARGO SHIPS, CONTROL SYSTEMS, ENGINEERING APPLICATIONS
OF COMPUTERS, RELIABILITY, MONITORING
   IDENTIFIERS: EXPERIENCE, COMPUTER BASED WATCHKEEPING, CONTROL SYSTEM
, UNMANNED ENGINE ROOM EQUIPMENT, DISTANT WATER FREEZER TRAWLER CLASS,
ELECTRONIC, RELIABILITY, FIXED LOGIC RELAY CONTROL CIRCUITS
   SECTION CLASS CODES: D6510, D2490

19165   D7404799
  EROSIVE PRODUCTION METHODS (WITH SPARK EROSION MACHINES) RATIONALISE
PRODUCTION
  LEISEDER, L.
  MASCHINENMARKT   (GERMANY)   VOL.80, NO.60   1165-8   26 JULY 1974
CODEN: MAMKAK
  DESCRIPTORS: EROSION, ELECTRICAL DISCHARGE MACHINING
  IDENTIFIERS: MACHINES, SPARK EROSION, NUMERICALLY CONTROLLED, ERODER
, STEEL, DIE, ACCURACY, DIGITAL POSITION INDICATION, PULSE GENERATOR,
ADAITIVE CONTROL SYSTEM, SURFACE ROUGHNESS, PORTAL TYPE, RATES
  SECTION CLASS CODES: D4450
  LANGUAGE: GERMAN
  (2 REFS)

18587   D7403581
  TORSIONAL RESPONSE OF INTERNAL COMBUSTION ENGINES
  ESHLEMAN, R.L.   ; IIT RES. INST., CHICAGO, ILL., USA
  TRANS. ASME SER. F (USA)   VOL.96, NO.2   441-9   MAY 1974   CODEN:
JEFIAB
  DESCRIPTORS: INTERNAL COMBUSTION ENGINE PERFORMANCE, SIMULATION,
VIBRATIONS, TORSION
  IDENTIFIERS: TORSIONAL   RESPONSE, INTERNAL COMBUSTION   ENGINES,
DIGITAL SIMULATION TECHNIQUE, REFINED MATHEMATICAL MODEL, END ITEM
POWER SHAFTS, NATURAL FREQUENCIES, MODE SHAPES, TORSIONAL MOTIONS,
STRESSES, FOURIER SERIES EXPANSION, FORCING FUNCTIONS, GASOLINE ENGINE
, DIESEL ENGINE, ENGINE PRESSURE CRANK ANGLE CURVE
  SECTION CLASS CODES: D5410
  (5 REFS)

17881   D7402875
  PRESSURE CHANGES, DUE TO EMERGENCY ARRANGEMENT, IN THE HP-PART AND
RE-PEATER OF A STEAM GENERATOR
  LEITHNER, R.
  BRENNST.-WAERME-KRAFT (BWK) (GERMANY)   VOL.26, NO.6   249-57   JUNE
1974   CODEN: BRWKAY
  DESCRIPTORS: BOILERS, PRESSURE, FLOW, ENGINEERING APPLICATIONS OF
COMPUTERS, MODELLING
  IDENTIFIERS: MODEL, STEAM GENERATOR, PRESSURE, CHANGES, ESTIMATE,
CALCULATE, ANALOGOUS, DIGITAL, COMPUTER, REHEATER, MASS FLOW, HP PART
  SECTION CLASS CODES: D5220
  LANGUAGE: GERMAN
  (9 REFS)

13567   D7406073
SIMULATION STUDY OF TRANSIENT PERFORMANCE MATCHING OF TURBOFAN
ENGINE USING AN ANALOGUE COMPUTER TO EVALUATE ITS USEFULNESS AS DESIGN
TOOL
   ITOH, M., ISHIGAKI, T., SAGIYA, Y. ; ISHIKAWAJIMA-HARIMA HEAVY
INDUSTRIES CO. LTD., TOKYO, JAPAN
   ; ASME
   INTERNATIONAL CONFERENCE ON GAS TURBINES (PREPRINTS)   1-6   1974
   31 MARCH - 4 APRIL 1974   ASME   ZURICH, SWITZERLAND
   PUBL: ASME   NEW YORK, USA
   DESCRIPTORS: TURBOPROP   ENGINES,   ENGINEERING   APPLICATIONS   OF
COMPUTERS, PRODUCT DESIGN
   IDENTIFIERS: SIMULATION   STUDY,   TRANSIENT   PERFORMANCE   MATCHING,
TURBOFAN ENGINE, ANALOGUE COMPUTER, DYNAMIC RESPONSE, DESIGN TOOL
   SECTION CLASS CODES: D5420, D1340

13459   D7405965
SPINDLE POSITIONING WITH A STEPPING MOTOR IN MULTI-SPINDLE AUTOMATIC
LATHES
   VAN DE LOO, P.
   IND.-ANZ. (GERMANY)   VOL.96, NO.25   543-8   22 MARCH 1974
   DESCRIPTORS: LATHES, POSITION CONTROL, STEPPING MOTORS
   IDENTIFIERS: SPINDLE POSITIONING, STEPPING MOTOR, AUTOMATIC LATHES,
DIGITAL CONTROL, HALL EFFECT GENERATOR, ZEROING TRANSMITTER
   SECTION CLASS CODES: D4410, D2450, D2210
   LANGUAGE: GERMAN
   (6 REFS)

12905   D7405411
   CALCULATION PROCEDURES FOR POTENTIAL AND VISCOUS FLOW SOLUTIONS FOR
(AIRCRAFT) ENGINE INLETS
   ALBERS, J.A., STOCKMAN, W.O.   ; NASA, CLEVELAND, OHIO, USA
   ; ASME
   INTERNATIONAL CONFERENCE ON GAS TURBINES (PREPRINTS)   1-8   1974
   31 MARCH - 4 APRIL 1974   ASME   ZURICH, SWITZERLAND
   PUBL: ASME   NEW YORK, USA
   DESCRIPTORS: AIRCRAFT   ENGINES,   VISCOUS   FLOW,   ENGINEERING
APPLICATIONS OF COMPUTERS, COMPRESSIBLE FLOW
   IDENTIFIERS: CALCULATION   PROCEDURES,   METHOD,   BASIC   ELEMENTS,
COMPUTER   SOLUTIONS,   POTENTIAL   FLOW,   ENGINE   INLETS,   SUPSONIC
CONVENTIONAL,   CTOL, STOL, VERTICAL TAKEOFF, VTOL, AIRCRAFT, NACELLES,
COMPRESSIBLE VISCOUS FLOW, MEASURED SURFACE PRESSURE DISTRIBUTIONS,
MODEL INLETS, PROGRAM, DESIGN, ANALYSIS, LIFT FANS, ACOUSTIC SPLITTERS
, COMPYN, VISCUS, SHORT HAUL
   SECTION CLASS CODES: D5420, D3510
   (23 REFS)

16677   D7403133
  AUTOMATING ENGINE AND EMISSION TESTING
  AUTOMOT. ENG. (USA)   VOL.81, NO.12   25-33   DEC. 1973   CODEN:
AVEGBI
  DESCRIPTORS: ENGINES, AUTOMATIC TESTING, ENGINEERING APPLICATIONS OF
COMPUTERS, EXHAUST GASES
  IDENTIFIERS: COMPUTER CONTROL, ENGINE TESTING, TESTING FLEXIBILITY,
REDUCES DOWNTIME, SAVES TECHNICAL MANPOWER, EMISSION TESTING
  SECTION CLASS CODES: D5400, D7831

9494   D7402000
  COMPUTER-ASSISTED CALCULATION   OF STRENGTH (USING FINITE ELEMENT
METHOD)
  BUCK, F.E., WINKLER, R.   : BROWN BOVERI, HEMSBACH, GERMANY
  BBC NACHR. (GERMANY)   VOL.55, NO.12   410-17   1973   CODEN: BBCNAZ
  DESCRIPTORS: COMPUTER-AIDED   DESIGN,   FINITE   ELEMENT   METHOD,
MECHANICAL STRENGTH
  IDENTIFIERS: STRENGTH, FINITE ELEMENTS, STRUCTURES, TILTING ARM,
CORELESS   INDUCTION FURNACE, GENERATOR, RADIATOR CASING, TURBINE
FOUNDATION, COMPUTER ASSISTED CALCULATION
  SECTION CLASS CODES: D1340, D3260
  (3 REFS)

6683   D7306683
  SIMULATION OF THERMODYNAMIC PROCESS OF A DIESEL ENGINE ON A SMALL
DIGITAL COMPUTER
  OJHA, V.P.   : DIESEL LOCOMOTIVE WORKS, VARANASI, INDIA
  J. INST. ENG. (INDIA) MECH. ENG. DIV.   VOL.53, NO. ME 6   292-301
JULY 1973   CODEN: JEMDAS
  DESCRIPTORS: DIESEL   ENGINES,   THERMODYNAMICS,   ENGINEERING
APPLICATIONS OF COMPUTERS
  IDENTIFIERS: SIMULATION, SMALL DIGITAL COMPUTER, MATHEMATICAL MODEL,
THERMODYNAMIC PROCESS, DIESEL ENGINE
  SECTION CLASS CODES: D5410, D5100
  (11 REFS)

5472   D7305472
  THE USE OF A HYBRID COMPUTER IN THE OPTIMISATION OF GAS TURBINE
(TURBOJET ENGINE THRUST RESPONSE) CONTROL PARAMETERS
  SARAVANAMUTTOO, H.I.H., MACISAAC, B.D.   : CARLETON UNIV., OTTAWA,
CANADA
  TRANS. ASME SER. A (USA)   VOL.95, NO.3   257-64   JULY 1973
CODEN: JEIOAB
  DESCRIPTORS: OPTIMISATION, GAS TURBINES,   TURBOJET   ENGINES,
SIMULATION, COMPUTER APPLICATIONS
  IDENTIFIERS: OPTIMISATION, GAS TURBINE, HYBRID COMPUTER, TURBOJET
ENGINE,   COMPRESSOR, THERMODYNAMICS, SIMULATION, THRUST RESPONSE,
CONTROL SYSTEM, ACCELERATION TRAJECTORY
  SECTION CLASS CODES: D5420
  (6 REFS)

5466　D7305466
GENERAL APPROACH TO THE COMPUTER SOLUTION OF SINGLE- AND TWO-STAGE
TURBOCHARGED DIESEL ENGINE MATCHING
　WALLACE, F.J., CAVE, I.R.　: UNIV. BATH, ENGLAND
　PROC. INST. MECH. ENG. (GB)　VOL.187, NO.48　535-47　1973
CODEN: PIMLAA
　DESCRIPTORS: DIESEL ENGINES, ENGINEERING APPLICATIONS OF COMPUTERS
　IDENTIFIERS: COMPUTER SOLUTION, TURBOCHARGED DIESEL ENGINE MATCHING
　SECTION CLASS CODES: D5410
　(28 REFS)

4897　D7304897
　:THORSHOLM:-FIRST SHIP WITH DATACHIEF (COMPUTER CONTROL ENGINE ROOM)
　SHIPBUILD. AND MAR. ENG. INT. (GB)　VOL.96, NO.1169　652-3　AUG.
1973
　DESCRIPTORS: MARINE ENGINES, CARGO SHIPS, COMPUTER APPLICATIONS
　IDENTIFIERS:　280000 TDW TANKER, MONITORING, ENGINE OPERATION,
PERFORMANCE, MERCHANT SHIP, COMPUTER CONTROL ENGINE ROOM
　SECTION CLASS CODES: D6510, D5410

424　D7300424
DIGITAL SIMULATION OF ROTARY PISTON ENGINES (OR WANKEL ENGINE)
　LAWTON, B., MILLAR, D.H., HUTCHINSON, D.P.　: ROYAL MILITARY COLL.
SCI., SWINDON, ENGLAND
　: INSTN. MECH. ENGRS. ET. AL
　CONFERENCE ON ENGINE PERFORMANCE MODELLING　25-37　1973
　22-23 MAY 1973　INSTN. MECH. ENGRS. ET. AL　LONDON, ENGLAND
　PUBL: INSTN. MECH. ENGRS.　LONDON, ENGLAND
　DESCRIPTORS:　WANKEL　ENGINES,　ROTARY　ENGINES,　ENGINEERING
APPLICATIONS OF COMPUTERS, MODELLING
　IDENTIFIERS:　DIGITAL SIMULATION,　ROTARY PISTON ENGINES, WANKEL
ENGINE, SPARK IGNITION, COMPRESSION IGNITION, MODELLING, THERMODYNAMIC
CYCLE
　SECTION CLASS CODES: D5410
　(10 REFS)

421　D7300421
THE COMPUTER MODELLING OF :LARGE: MECHANICAL SYSTEMS-DYNAMIC AND
KINEMATIC ANALYSIS (OF V-8 ENGINE)
　TIMM, R.F., LARSON, C.S., NAGAMATSU, H.H.　: MICHIGAN TECHNOL.
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RIGID BODY SYSTEM, INTERNAL COMBUSTION ENGINE
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62   D7300062
    PULSE-COUNTING SIGNAL SYSTEMS FOR N.C
    PESCHANSKII, B.I.
    STANKI AND INSTRUM. (USSR)   NO.12   11-12   1972   CODEN: STINA4
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MCTOAD
    DESCRIPTORS: NUMERICAL CONTROL, DISPLAY INSTRUMENTS
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CALCULATING,   VARIOUS   SYSTEMS,   DESIGN,   CIRCUIT,   START STOP GENERATOR,
PULSE COUNTING SIGNAL SYSTEMS, NC, MULTI DIGIT COUNTERS, MACHINE TOOLS
    SECTION CLASS CODES: D2440, D4400
    (2 REFS)

ASSEMBLY LANGUAGE PROGRAM
TO IMPLEMENT BANG-BANG REGULATION TECHNIQUES

```
00001:                        *  AP23,24,25 JUNE 15,1976
00002:                        *  START FROM ZERO
00003: 00000           00000           REL     0
00004: 00000  00001 00001      UP      BSS     1,1
00005: 00001  XXXXX 00235      ADVOR   ADR     VORD
00006: 00002  00000 00000      LIN     BSS     1,0
00007: 00003  XXXXX 00112      ADLP3   ADR     LP3
00008: 00004  XXXXX 00012      ADLP1   ADR     LP1
00009: 00005  XXXXX 00073      ADLP2   ADR     LP2
00010: 00006  00001 00001      DGTL    BSS     1,1
00011: 00007  00001 00001      ONE     BSS     1,1
00012: 00010  26740                    CLR
00013: 00011  161771 00002             STA     LIN
00014: 00012  65222 00234      LP1     L,I     ADCNI
00015: 00013  65132 00145              L,I     CONR
00016: 00014  61136 00152              L       REFRD
00017: 00015  65764 00001              L,I     ADVOR
00018: 00016  141762 00000             LA      UP
00019: 00017  20203                    OCA
00020: 00020  24100                    SAE
00021: 00021  45127 00150              J,I     ADWN
00022: 00022  141154 00176             LA      REF
00023: 00023  175124 00147             S,I     ADBP
00024: 00024  121151 00175             C       VO
00025: 00025  27414                    SLE
00026: 00026  41764 00012              J       LP1
00027: 00027  141147 00175             LA      REF
00028: 00030  121145 00175             C       VO
00029: 00031  27412                    SGE
00030: 00032  45116 00150              J,I     ADWN
00031: 00033  141751 00004             LA      ADLP1
00032: 00034  161177 00233             STA     POINT
00033: 00035  141112 00147             LA      ADBP
00034: 00036  20040                    AOA
00035: 00037  121165 00224             C       ADDUM
00036: 00040  27404                    SL
00037: 00041  55125 00145              L,I     ADLCN
00040: 00042  71105 00147              AOM     ADBP
00039: 00043  71105 00151              AOM     ADGCN
00040: 00044  65101 00145              L,I     CONR
00041: 00045  26740                    CLR
00042: 00046  161734 00002             STA     LIN
00043: 00047  41743 00012              J       LP1
00044: 00050  26740            DWN     CLR
00045: 00051  161727 00000             STA     UP
00046: 00052  141124 00176             LA      REF
00047: 00053  155074 00147             A,I     ADBP
00048: 00054  121121 00175             C       VO
00049: 00055  27404                    SL
00050: 00056  41004 00062              J       *+4
00051: 00057  26740                    CLR
00052: 00060  161722 00002             STA     LIN
00053: 00061  41012 00073              J       LP2
00054: 00062  141722 00004             LA      ADLP1
00055: 00063  161150 00233             STA     POINT
00056: 00064  141063 00147             LA      ADBP
00057: 00065  20040                    AOA
00058: 00066  121135 00224             C       ADDUM
```

```
00059: 00057  27404                    SL
00060: 00070  65055 00146              L,I    ADLCN
00061: 00071  26740              .     CLR
00062: 00072  161713 00002             STA    LIN
00063: 00073  141056 00151      LP2    LA     ADCON
00064: 00074  171713 00007             S      ONE
00065: 00075  121127 00224             C      ADDUM
00066: 00076  27402                    SG
00067: 00077  41012 00111              J      XX
00068: 00100  161051 00151             STA    ADCON
00069: 00101  141046 00147             LA     ADBP
00070: 00102  171705 00007             S      ONE
00071: 00103  161044 00147             STA    ADBP
00072: 00104  145043 00147             LA,I   ADBP
00073: 00105  151071 00175             A      REF
00074: 00106  121267 00175             C      VO
00075: 00107  27412                    SGE
00076: 00110  41763 00073              J      LP2
00077: 00111  61142 00253       XX     L      CONO
00078: 00112  51040 00152       LP3    L      REFRD
00079: 00113  61122 00235              L      VORD
00080: 00114  141062 00176             LA     REF
00081: 00115  155032 00147             A,I    ADBP
00082: 00116  125054 00172             C,I    ADVO
00083: 00117  27402                    SG
00084: 00120  41772 00112              J      LP3
00085: 00121  141055 00176             LA     REF
00086: 00122  121053 00175             C      VO
00087: 00123  27402                    SG
00088: 00124  41004 00130              J      *+4
00089: 00125  20000                    CAO
00090: 00126  161052 00000             STA    UP
00091: 00127  41223 00352              J      LP4
00092: 00130  141653 00003             LA     ADLP3
00093: 00131  161102 00233             STA    POINT
00094: 00132  141015 00147             LA     ADBP
00095: 00133  20040                    AOA
00096: 00134  121370 00224             C      ADDUM

00097: 00135  27404                    SL
00098: 00136  65010 00146              L,I    ADLCN
00099: 00137  26740                    CLR
00100: 00140  161642 00002             STA    LIN
00101: 00141  71206 00147              AOM    ADBP
00102: 00142  71207 00151              AOM    ADCON
00103: 00143  61110 00253              L      CONO
00104: 00144  41746 00112              J      LP3
00105: 00145  XXXXX 00253      CONR    ADR    CONO
00106: 00146  XXXXX 00406      ADLCN   ADR    LCNT
00107: 00147  XXXXX 00177      ADBP    ADR    BREAK
00108: 00150  XXXXX 00050      ADWN    ADR    DWN
00109: 00151  XXXXX 00212      ADCON   ADR    CTRL
00110:                    * READ REFERENCE VOLTAGE
00111: 00152  00000 00000      REFRD   ADR    0
00112: 00153  141020 00173             LA     GAIN
00113: 00154  25270 00070              SR     '70
00114: 00155  24070 00070              SL     '70
00115: 00156  131013 00171             AND    MASK
00116: 00157  27427                    SNZ
```

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00117:  00150  41775  00155            J       *-3
00118:  00151  02070  00070            DI      '70
00119:  00152  26250  00010            LRS     '10
00120:  00153  20100         .         TCA
00121:  00154  26210  00010            LLS     '10
00122:  00155  26250  00010            LRS     '10
00123:  00156  161010  00175           STA     REF
00124:  00157  45753  22152            J,I     REFRD
00125:  00170  00000  00000   RFVOL    BSS     1,0
00126:  00171  40000  40000   MASK     BSS     1,'40000
00127:  00172  XXXXX  00175   ADVO     ADR     VO
00128:  00173  00000  00000   OAIN     BSS     1,0
00129:  00174  00000  00012   MDER     DEC     10
00130:  00175  00000  00000   VO       BSS     1,0
00131:  00175  00000  00000   REF      BSS     1,0
00132:  00200  00000  00000   STEAR    BSS     10,0
00133:  00211  00000  00000   DUM      BSS     1,0
00134:  00212  00000  00000   DGTL     BSS     1,0
00135:  00224  XXXXX  00211   ADDUM    ADR     DUM
00136:  00225  XXXXX  00226   AUP      ADR     UP
00137:  00226  XXXXX  00012   ALPI     ADR     LPI
00138:  00227  XXXXX  00002   ALIN     ADR     LIN
00139:  00230  XXXXX  00233   APNT     ADR     POINT
00140:  00231  XXXXX  00176   AREF     ADR     REF
00141:  00232  XXXXX  00006   ADGTL    ADR     DGTL
00142:  00233  00000  00000   POINT    ADR     0
00143:  00234  XXXXX  00372   ADCNI    ADR     CONI
00144:                        *  READ OUTPUT VOLTAGE + COMPARE
00145:  00235  00000  00000   VORD     ADR     0
00146:  00236  141014  00252           LA      VOGN
00147:  00237  05070  00070            DF      '70
00148:  00240  04070  00070            SI      '70
00149:  00241  131730  00171           AND     MASK
00150:  00242  27407                   SNZ
00151:  00243  41775  00240            J       *-3
00152:  00244  02070  00070            DI      '70
00153:  00245  26250  00010            LRS     '10
00154:  00246  20100                   TCA
00155:  00247  26210  00010            LLS     '10
00156:  00250  161725  00175           STA     VO
00157:  00251  45764  00235            J,I     VORD
00158:  00252  00001  00001   VOGN     BSS     1,1
00159:                        *  OUTPUT CONTROL WORD
00160:  00253  00000  00000   CONO     ADR     0
00161:  00254  141046  00322           LA      CHAN
00162:  00255  05076  00076            DF      '76
00163:  00256  145754  00232           LA,I    ADGTL
00164:  00257  121530  00007           C       ONE
00165:  00260  27406                   SNE
00166:  00261  41003  00254            J       *+3
00167:  00262  141122  00404           LA      ANA
00168:  00263  41013  00275            J       OUT
00169:  00264  141514  00000           LA      UP
00170:  00265  121522  00007           C       ONE
00171:  00266  27412                   SE
00172:  00267  41004  00273            J       *+4
00173:  00270  145651  00151           LA,I    ADCON
00174:  00271  26210  00010            LLS     '10
```

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00175:  00272   41004 00276          J         OUT
00176:  00273  145656 30151          LA,I      ADCON
00177:  00274   20100               TCA
00178:  00275   26210 30010          LLS       *10
00179:  00276   23500          OUT  SSW        B
00180:  00277   41237 00306          J         ROUT
00181:  00300   61072 00372          L         CONE
00182:  00301  141103 00404          LA        ANA
00183:  00302   03076 00076          DO        '76
00184:  00303  141504 00007          LA        ONE
00185:  00304   05076 00076          DF        '76
00186:  00305   26740               CLR
00187:  00306   03076 00076    ROUT DO         '76
00188:  00307  141500 00007          LA        ONE
00189:  00310   05076 00076          DF        '76
00190:  00311  145721 00232          LA,I      ADGTL
00191:  00312  121475 00007          C         ONE
00192:  00313   27410               SE
00193:  00314   41003 00317          J         *+3
00194:  00315  141067 00404          LA        ANA
00195:  00316   41002 00320          J         *+2
00196:  00317   26740               CLR
00197:  00320   03076 00076          DO        '76
00198:  00321  145732 00253          U,I       CONO
00199:  00322   00000 00000   CHAN   BSS       1
00200:  00323  XXXXXX 00007   GAONE  ADP       ONE
00201:                         * NOT UNDER LINEAR CONTROL
00202:  00324   27400          IDLE  NOP
00203:  00325   61045 00372          L         CONP
00204:  00326   61725 00253          LA        CONO
00205:  00327   61623 00152          L         REFRD
00206:  00330   61735 00235          L         WORD
00207:  00331  141645 00176          LA        REF
00208:  00332  155615 00147          A,L       ADBP
00209:  00333  121642 00175          C         VO
00210:  00334   27402               SG
00211:  00335   41002 00337          J         *+2
00212:  00336   41004 00342          J         *+4
00213:  00337   20000               CAO
00214:  00340  161446 00006          STA       DGTL
00215:  00341   41507 00050          J         DWN
00216:  00342  141634 00176          LA        REF
00217:  00343  175604 00147          S,I       ADBP
00218:  00344  121631 00175          C         VO
00219:  00345   27402               SG
00220:  00346   41756 00324          J         IDLE
00221:  00347   20000               CAO
00222:  00350  161436 00006          STA       DGTL
00223:  00351  165654 00225          STA,I     AUP
00224:  00352  141577 00151    LP4  LA         ADCON
00225:  00353  175750 00323          S,I       AONE
00226:  00354  121550 00224          C         ADUMS
00227:  00355   27402               SG
00228:  00356   41012 00372          J         YY
00229:  00357  161572 00151          STA       ADCON
00230:  00360  141567 00147          LA        ADBP
00231:  00361  175742 00323          S,I       AONE
00232:  00362  161555 00147          STA       ADBP
```

```
233:  33363  141613  20176              LA      REF
33234: 33064  175563  33147             S,I     ADBP


  35:  00365  121012  00175             C       VO
33235: 00365  27404                     SL
20237: 92357  41763   00352             J       LP4
33238: 00078  45636   33226    YY       J,I     ALP1
33239: 00371  XXXXX   20175    AVO      ADR     VO
00240:                         *  READ IN LINEAR CONTROL
00241: 00372  00000   00300    CONI     ADR     0
00242: 03373  141812  00405             LA      LNGN
03243: 02374  05070   33070             DF      '70
30244: 33375  24273   00070             SI      '70
20245: 30376  131573  00171             AND     MASK
30246: 20377  27407                     SNZ
32247: 30400  41775   33375             J       *-3
33248: 00401  02070   00070             DI      '70
20249: 00402  161002  00404             STA     ANA
30250: 02403  45767   00372             J,I     CONI
33251: 02404  00300   00000    ANA      BSS     1,0
33252: 30405  30002   30002    LNGN     BSS     1,2
03253:                         *  DETERMINES IF SYSTEM READY FOR LINEAR CONTROL

30254: 30406  00030   33000    LCNT     ADR     0
33255: 30407  75620   00227             AOM,I   ALIN
20256: 30410  145617  30227             LA,I    ALIN
33257: 30411  121036  00417             C       GOLN
03258: 00412  27412                     SGE
33259: 00413  45620   00233             J,I     POINT
33260: 00414  26740                     CLR
00261: 30415  165615  30232             STA,I   ADGTL
20262: 30416  41706   30324             J       IDLE
00263: 32417  30005                     GOLN    DEC     5
33254:               00000             END     0
```

STUDY OF EFFECT OF LOWER MAIN FIELD TIME CONSTANTS

The time constant of the main field and the exciter field are associated with the lowest frequency band of the alternator control spectrum. In view of this the main field time constant was changed from 0.133 seconds to 0.364 seconds to determine the effect on control stability. The gain was adjusted to provide the same bandwidth of 20 Hz as shown in the curve of M, in Figure 4-12.

The results of the change in time constant are noted in the curve of M_1 where the peak at 11 Hz is slightly higher when no compensation issued. Using the same compensation (lead at 3.3 Hz and lag at 13.3 Hz) as used for M_2 of Figure 4-12, we find that the characteristic of M_2 in D-1 is flat within 0.5 db out to 20 Hz. Optimization of the compensation could improve this characteristic.

Figure D-2 shows the transfer of open loop to closed loop for the main field time constant of .364 and an open loop gain of 57 db/S as plotted on a Nichols Chart. This gain would provide about an 11 Hz bandwidth for the uncompensated case. Increase of gain to 64 db/S provides the closed loop characteristic recorded in M_1 of Figure D-1. The compensated case has the desired gain (57 db/S) as shown and produces the closed loop characteristic shown as M_2 in Figure D-2.
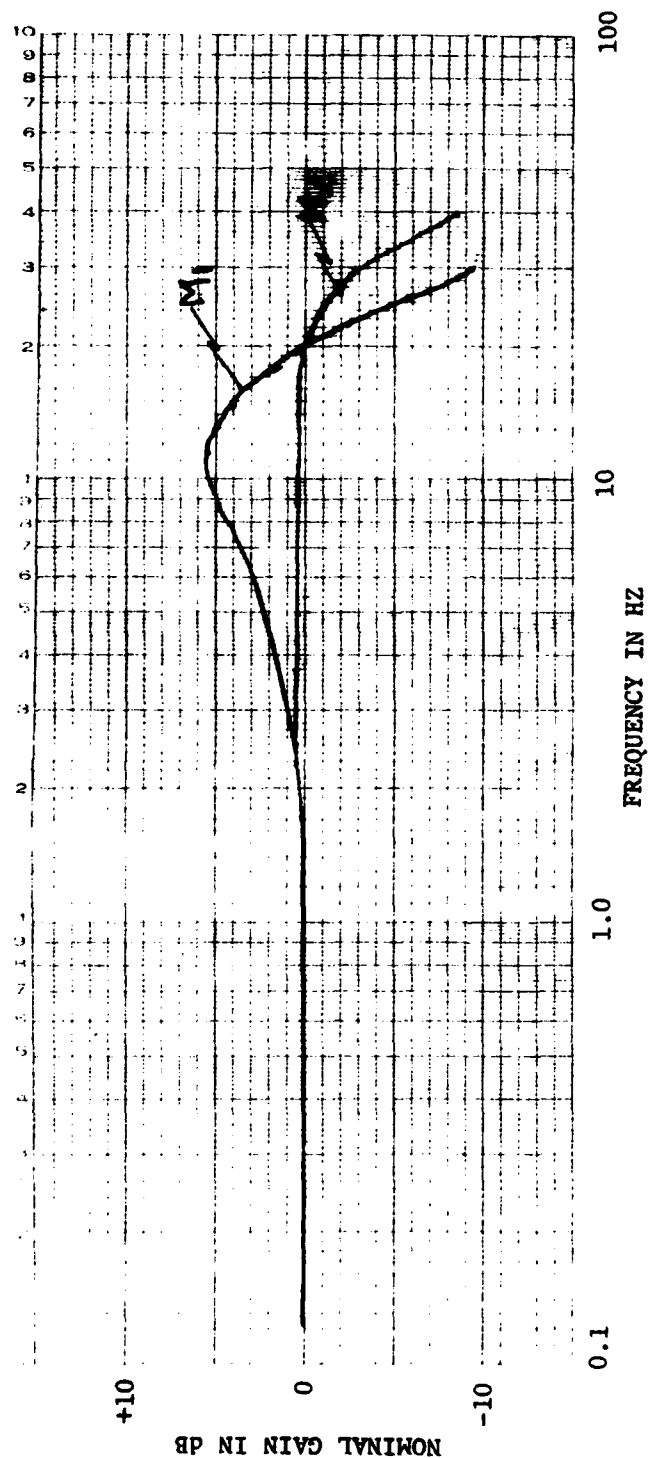
Figure D-1. Alternator Voltage Control
Closed Loop Frequency Response
M_1 - Without Compensation
M_2 - With Compensation

Figure D-2. Alternator Voltage Control Transfer Open to Closed Loop
M_1 - Without Compensation
M_2 - With Compensation

$\dfrac{E_f}{10}$

$\dfrac{7.72}{(.133S+1)}$

$\dfrac{\Theta}{500}$

$\dfrac{T}{100}$

4.55

$\dfrac{1.208}{(.154\times10^{-6}S^2 + .04\times10^{-3}S + 1)}$

$10^6\Theta_0$

$\dfrac{T_i}{100}$

$\dfrac{G = 1 - 100}{(.015S+1)(1.15\times10^{-6}S^2 + 3.15\times10^{-3}S+1)}$

$10X_T$

$\dfrac{S\Theta_r}{100}$

AC-APU Dynamics Block Diagram

APPENDIX B

MICROCOMPUTER CONTROL SYSTEM SOFTWARE

B-1. BRIEF DISCUSSION ON TYPES OF CONTROL

Three types of control are ordinarily considered:

1. Proportional

$$K_p e$$

where e = desired value - actual value

2. Integral

$$K_I \int_0^t e \, dt$$

3. Derivative

$$K_D \frac{de}{dt}$$

Proportional control is always desireable. Integral control is used when the steady state error must be small since the integral control signal will grow indefinitely for any error however small. However, too much integral control may lead to instability especially if there are large time delays in the response of the system. Derivative control tends to stabilize the system and to offset time delays.

In the voltage control system, the specifications require a small steady state error, therefore integral control is necessary. The time delays mainly in the exciter and generator field circuits are relatively small and it was possible to stabilize the system without derivative control. Therefore, in the voltage control system, the control function consists of integral plus proportional control. The control signal = $K_p e + K_I \int_0^t e \, dt$.

The specifications for speed control do not require as small a steady error as in voltage control. Therefore, integral control isn't necessary. The system time delays mainly due to the generator and engine inertias are large and derivative control helps to stabilize the system. Therefore, the speed (frequency) control system consists of proportional plus derivative control. The control signal = $K_p e + K_D \frac{de}{dt}$. Integral control was tried in the frequency control system. However, even a small amount of integral control tended to make the system oscillate, so the best performance was obtained with no integral control.

B-2. EQUATIONS RELATING TO DEVELOPMENT OF VOLTAGE CONTROL ALGORITHM

Vg = Generator voltage in RMS volts

$K_1 Vg$ = d-c voltage after rectification where K_1 is dependent on potentiometer R30 (Three Phase Voltage to Analog Switch Circuit

I_f = field current

$K_1 Vdes$ = d-c reference voltage (created by -12 V through circuitry consisting of R4, D1, D2, R3, and potentiometer R1 in Three Phase Voltage to Analog Switch Circuit)

$Vg = Kg I_f$ Generator Equation (1)
where: Kg = slope of generator air gap line

$Ee_x = R_f I_f + L_f \dfrac{dI_f}{dt}$ Main Field Equation (2)

$Vc = Rex\ Iex + Lex \dfrac{dIex}{dt}$ Rotary Exciter Equation (3)

$Eex = Kex\ Iex$ = Voltage applied to main field by rotary exciter (4)
where: Kex = slope of exciter saturation curve

R_f = Main field resistance

L_f = Main field inductance

Vc = Voltage from computer

Iex = Rotary Exciter field current

Rex = Rotary Exciter field resistance

Lex = Rotary Exciter Field inductance

$K(Vdes - Vg)$ = voltage to A to D converter

$V_C = KpK_1 (Vdes - Vg) + K_I \displaystyle\int K_1 (Vdes - Vg)dt =$ (5)
Control equation (Proportional & Integral) where: Kp & K_I are parameters set in computer program.

Taking Laplace transformers of equations (1), (2), (3) & (4)

$\underline{Vg} = Kg\ \underline{I}_f$ (6)

$\underline{Eex} = (R_f + sL_f)\ \underline{I}_f = R_f\ \underline{I}_f (1 + s T_f)$ (7)

$\underline{Vc} = (Rex + sLex)\ \underline{Iex} = Rex\ Iex\ (1 + s T_{ex})$ (8)

$\underline{Vc} = K_1 \left(\dfrac{Vdes}{s} - \underline{Vg}\right) \left[Kp + \dfrac{K_I}{s}\right]$ (9)

$\underline{Eex} = Kex\ \underline{Iex}$

NOTE: The underscore under a quantity indicates Laplace transform

$$Tf = \frac{L_f}{R_f} \qquad , \qquad Tex = \frac{Lex}{Rex}$$

$$\underline{Vg} = Kg \; \underline{1}_f = \frac{Kg \; Eex}{R_f \; (1+sT_f)} \qquad = \frac{Kg \; Kex \; \underline{Vc}}{Rex \; R_f \; (1+sT_f)(1+sTex)}$$

$$\underline{Vg} = \frac{Kg \; Kex \; K_1 K_I \left[1 + \frac{Kp}{K_I} s \right]}{R_f \; Rex \; s(1+sT_f) \; (1+sTex)} \qquad \left(\frac{Vdes}{s} - \underline{Vg} \right)$$

$$\underline{Vg} = \frac{K \left(1 + \frac{Kp}{K_I} s \right)}{s(1+sT_f)(1+sTex)} \qquad \left(\frac{Vdes}{s} - \underline{Vg} \right)$$

$$\underline{Vg} = \frac{K \left(1 + \frac{Kp}{K_I} s \right)}{s(1+sT_f) \; (1+sTex) + K \left(1 + \frac{Kp}{K_I} s \right)} \qquad \frac{Vdes}{s} \qquad (10)$$

$$\text{Where:} \quad K = \frac{Kg \; Kex \; K_1 K_I}{R_f \; Rex}$$

To get steady state value of Vg apply final value theorem

$$Vg \text{ steady state} = \lim_{s \to 0} s \underline{Vg}$$

Vg steady state $\cong$ Vdes $\qquad$ as it should

If Kp & K_I are chosen such that

$$\frac{Kp}{K_I} = T_f$$

$$\underline{Vg} = \frac{K}{s(1+sTex) + K} \; \frac{Vdes}{s} \qquad (11)$$

Equation (11) is equivalent to the differential equation

$$Tex \; \frac{d^2Vg}{dt^2} + \frac{dVg}{dt} + KVg = K \; Vdes \qquad (12)$$

To model the effect of applying or removing load assume the machine is running in steady state with Vg = Vdes and Vdes is suddenly changed from Vdes to Vdes + Δv .

Solving equation (12) with initial conditions:

$$t = 0 \quad , \quad Vg = Vdes + \Delta V$$
$$\frac{dVg}{dt} = 0$$

Which gives rise to:

$$\underline{Vg} = \frac{Vdes + \Delta V}{s} - \frac{K}{s(Tex\ s+1)+K} \quad \frac{\Delta V}{s}$$

This corresponds to a sudden jump from Vdes to Vdes + ΔV followed by a decrease to Vdes governed by the time function corresponding to:

$$\frac{K}{s(Tex\ s +1) +K} \quad \frac{\Delta V}{s}$$

The time function is:

$$Vg = Vdes + \left(\frac{1-A}{2A} e^{-\alpha_1 t} - \frac{1+A}{2A} e^{-\alpha_2 t} \right) \Delta V$$

$$\text{Where:} \quad A = \frac{1}{Tex} \sqrt{1-4KTex}$$

$$\alpha_1 = \frac{1}{2Tex}(1+A)$$

$$\alpha_2 = \frac{1}{2Tex}(1-A)$$

A sketch of Vg is:
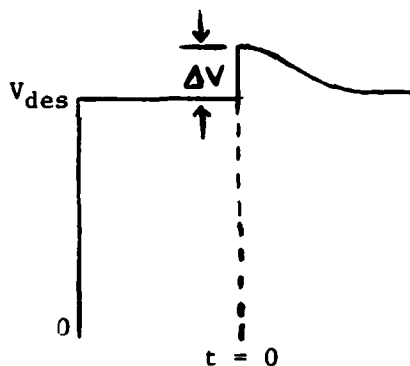
ΔV is positive for removal of load and negative for application of load

This is qualitatively the same as oscillograms taken on the real system (see Appendix D).

A simple block diagram of the entire system is illustrated below.

d.c. voltage

Measured V_g, 400Hz, a.c. → Rectifier and Voltage Divider → $K_1 V_g$, $\sum$ → $V_c = K_1(V_{des} - V_g)$

$+$ $K_1 V_{des}$

Reference Voltage

Digital Numbers

A to D → Computer K_p, K_I

$$V_c = K_p (V_{des} - V_g) + \int_0^t K_I (V_{des} - V_g)dt$$

Pulse Width Modulator

2000Hz

$\leftarrow$ T on $\rightarrow$ | $\leftarrow$ T $\rightarrow$

V max

0

V_c

$$V_c = V_{max} \quad \frac{T \text{ on}}{T}$$

Field Driver → Rotary Exciter → Main Field → Generator Armature

V_g
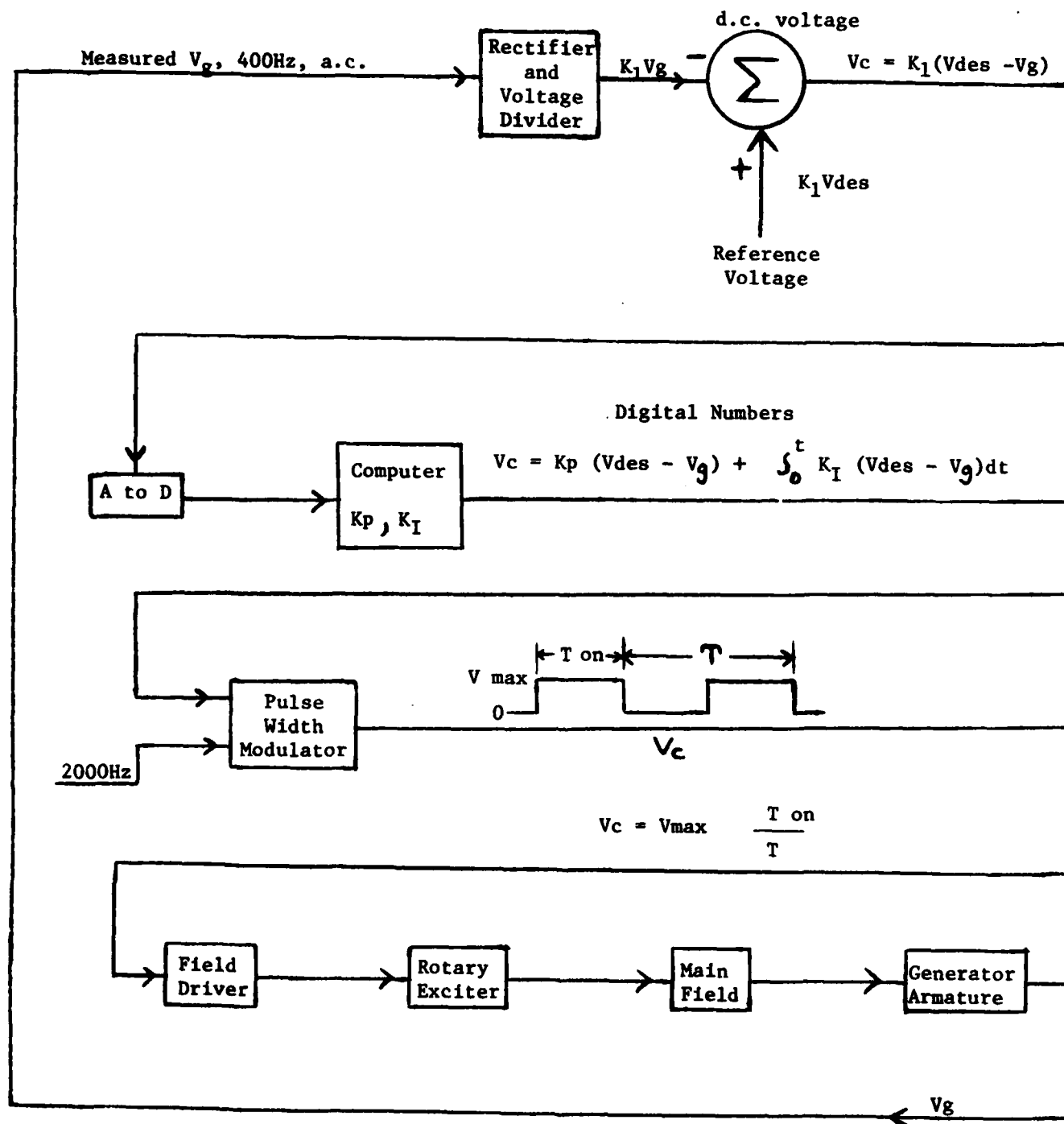
B-3. VOLTAGE CONTROL ALGORITHM

221 (B-7 of B-30)
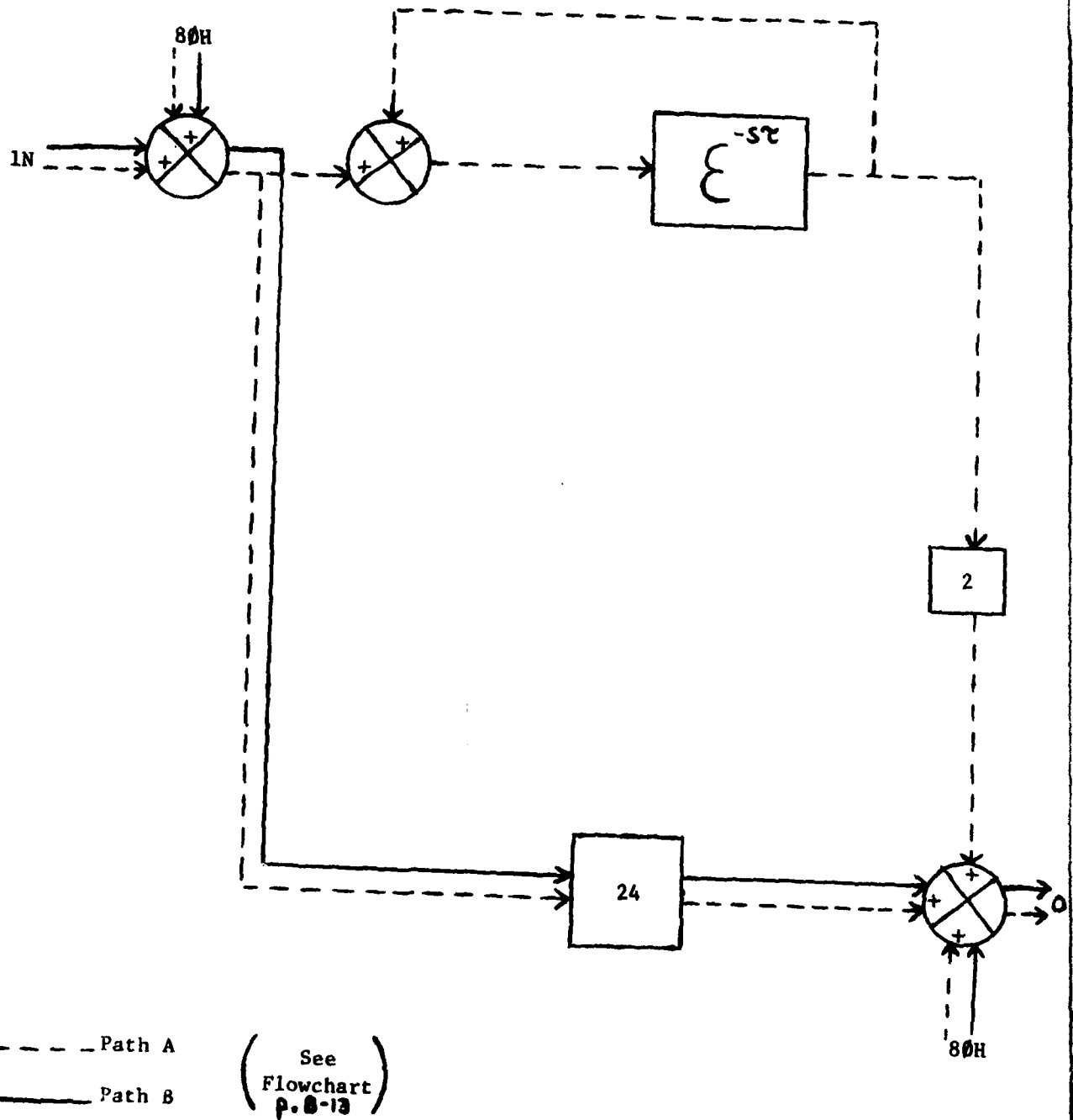
B-4. EQUATIONS RELATING TO DEVELOPMENT OF FREQUENCY REGULATION ALGORITHM

For Generator:

$$f = \frac{W_g\ P\pi}{3600}$$

Where: f = Frequency of generator voltage in Hz
   W_g = Speed of engine in radians/second
   p = Number of poles in generator = 24

$$f = \frac{\frac{60000}{\pi}(24)\ \pi}{3600} = 400 \qquad \left(\frac{60000}{\pi}\ \frac{rad}{sec} = 2000\ RPM\right)$$

For Diesel Engine:

$$J\ \frac{dW_g}{dt} + K_f\ W_g = \gamma_e - \gamma_g$$

Where: $\gamma_g = \frac{P_e}{W_g} = \frac{\sqrt{3}\ V_g\ I_a\ \cos\theta}{W_g}$

$\gamma_e = K_e\ X \quad (X = K_a V_c)$

J = Moment of inertia of engine and generator in watt-sec^3

W_g = Speed of engine in rad/sec

K_f = Damping coefficient in watt-secs^2

γ_e = Engine torque in watt-secs

γ_g = Generator torque in watt-secs

X = Fuel pump position in radians

K_e = Engine gain in $^{watt-secs}/radian$

K_a = Woodward actuator gain

$$J\ \frac{dW_g}{dt} + K_f\ W_g = K_e\ K_a\ V_c - \gamma_g$$

$$V_c = K_p\ (f_{des} - f) + K_d\ \frac{d\ (f_{des} - f)}{dt}$$

$$f_{des} - f = \frac{p\pi}{3600}\ (W_g\ des - W_g)$$

Taking Laplace transforms for no load ($\gamma g = 0$)

$$(J_S + K_f)\, \underline{Wg} = Ke\, Ka\, \frac{p\,\pi}{3600}\, \left[Kp + s\,Kd\right]\!\left(\frac{Wg\ des}{S} - \underline{Wg}\right)$$

Where: $K = \dfrac{Ke\ Ka\ p\,\pi\ Kp}{3600}$

Note: Underscore indicates Laplace transform

$$\left[J_S + K_f + K\left(s\,\frac{Kd}{Kp} + 1\right)\right]\underline{Wg} = K\left(s\,\frac{Kd}{Kp} + 1\right)\ \frac{Wg\ des}{S}$$

$$\underline{Wg} = \frac{K\left(1 + S\,\dfrac{Kd}{Kp}\right)}{\left(J + K\,\dfrac{Kd}{Kp}\right)S + K_f + K}\ \frac{Wg\ des}{S}$$

Wg steady state $= \lim\limits_{S \to 0}\ S\,\underline{Wg}$

Wg steady state $= \dfrac{K}{K_f + K}\ Wg\ des$

Therefore if $K \gg K_f$ the steady state speed will have the desired value.

$$\Delta Wg\ =\ \frac{KK_L}{(K_f + K)(K_f + K_L + K)}\ Wg\ des$$

for $K_f = 0$

$$\Delta Wg\ =\ \frac{K_L}{K_L + K}\ Wg\ des$$

If $\dfrac{\Delta Wg}{Wg\ des} = \dfrac{5}{400}$ & $K_L = .01$ watt-sec^2

$$\Delta Wg = \frac{.01}{.01 + K} = \frac{5}{400}$$

$$4 = .05 + 5K$$

$$K = \frac{3.95}{5} = 7.9\ \text{watt-sec}^2$$

A K of 7.9 will be enough to hold frequency within 4 Hertz.

For load on generator proportional to Wg; $\mathcal{Y}_g = K_L \underline{W}g$

$$\left[J_S + K_f + K \left(S \frac{Kd}{Kp} + 1\right)\right] \underline{W}g = K \left(S \frac{Kd}{Kp} + 1\right) \frac{Wg\ des}{S} - K_L \underline{W}g$$

$$\left[J_S + K_f + K_L + K\left(S \frac{Kd}{Kp} + 1\right)\right] \underline{W}g = K \left(S \frac{Kd}{Kp} + 1\right) \frac{Wg\ des}{S}$$

$$\underline{W}g = \frac{K \left(S \frac{Kd}{Kp} + 1\right)}{\left(J + K \frac{Kd}{Kp}\right)S + K_f + K_L + K} \quad \frac{Wg\ des}{S}$$

In Steady State:

$$Wg = \frac{K}{K_f + K_L + K} \quad Wg\ des \qquad \text{under load}$$

$$\Delta Wg = \left(\frac{K}{K_f + K} - \frac{K}{K_f + K_L + K}\right) \quad Wg\ des \qquad \begin{array}{l}\text{Change from no load} \\ \text{to full load}\end{array}$$

A simple block diagram of the frequency control scheme is illustrated below:

Vg — 400HZ — Comparator — 1250 μ secs = count for 1/2 cycle

2500 μ sec

digital numbers

Proportional to — Computer — $Vc = (fdes - f) Kp + K \dfrac{d(fdes-f)}{dt}$

fdes - f

Pulse Width Modulator — $Vc = Vmax \dfrac{T on}{T}$

2000 HZ
$T = 500 \mu sec$

Actuator Driver → Woodward Actuator → Fuel Pump → Diesel Engine → Gen.

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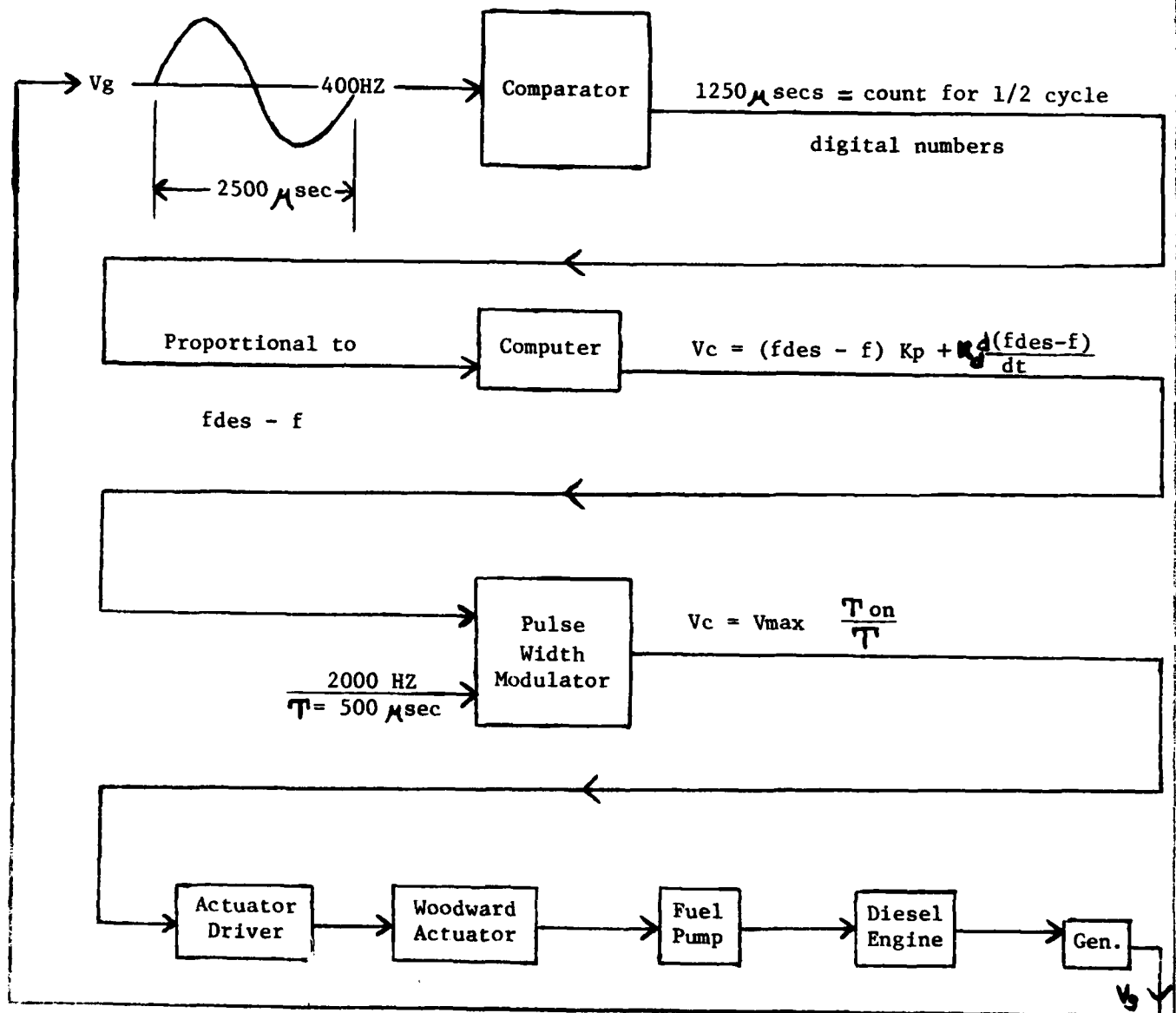
B-5. <u>FREQUENCY CONTROL ALGORITHM</u>
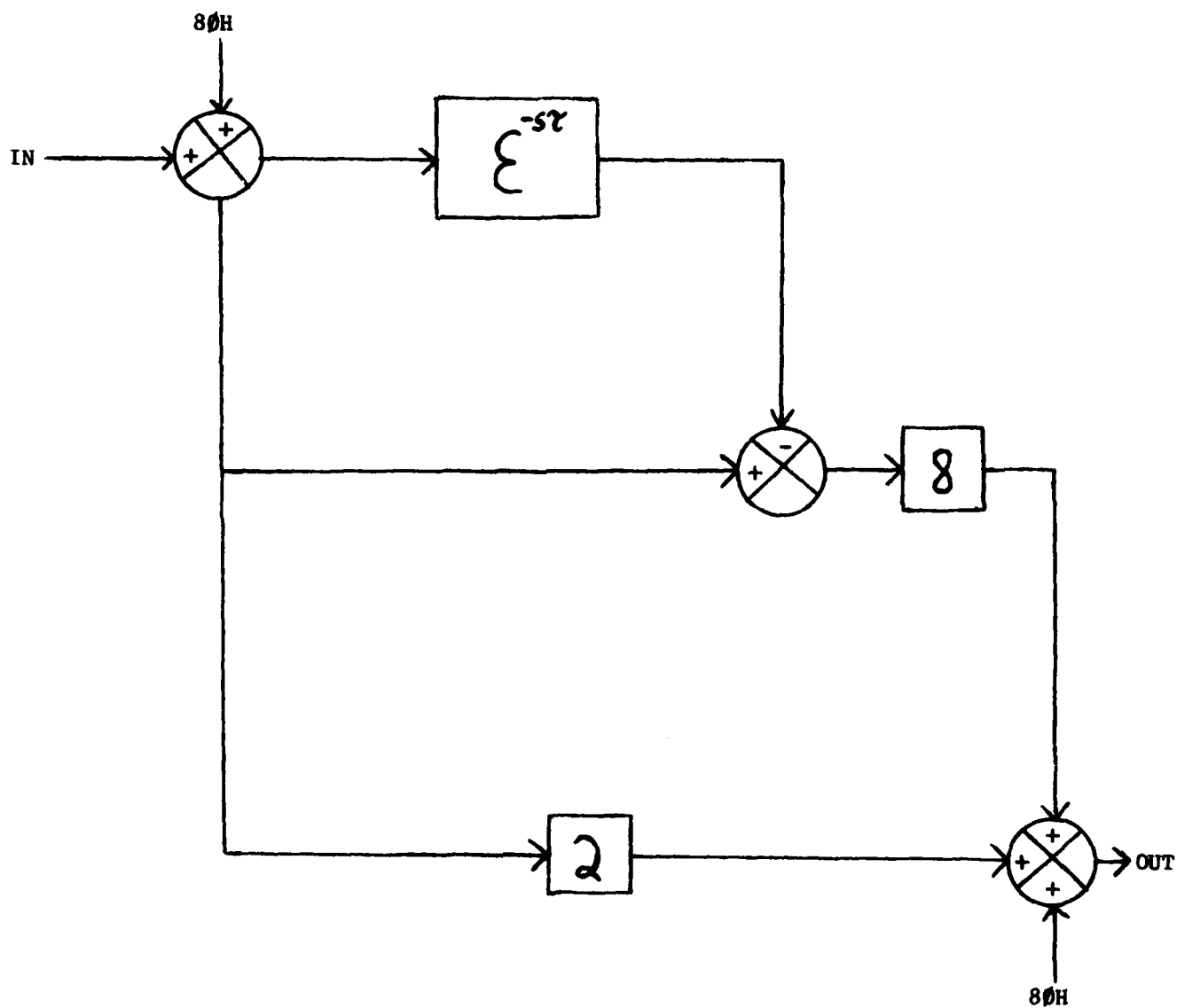
B-6. CONTROL SYSTEM FLOWCHART

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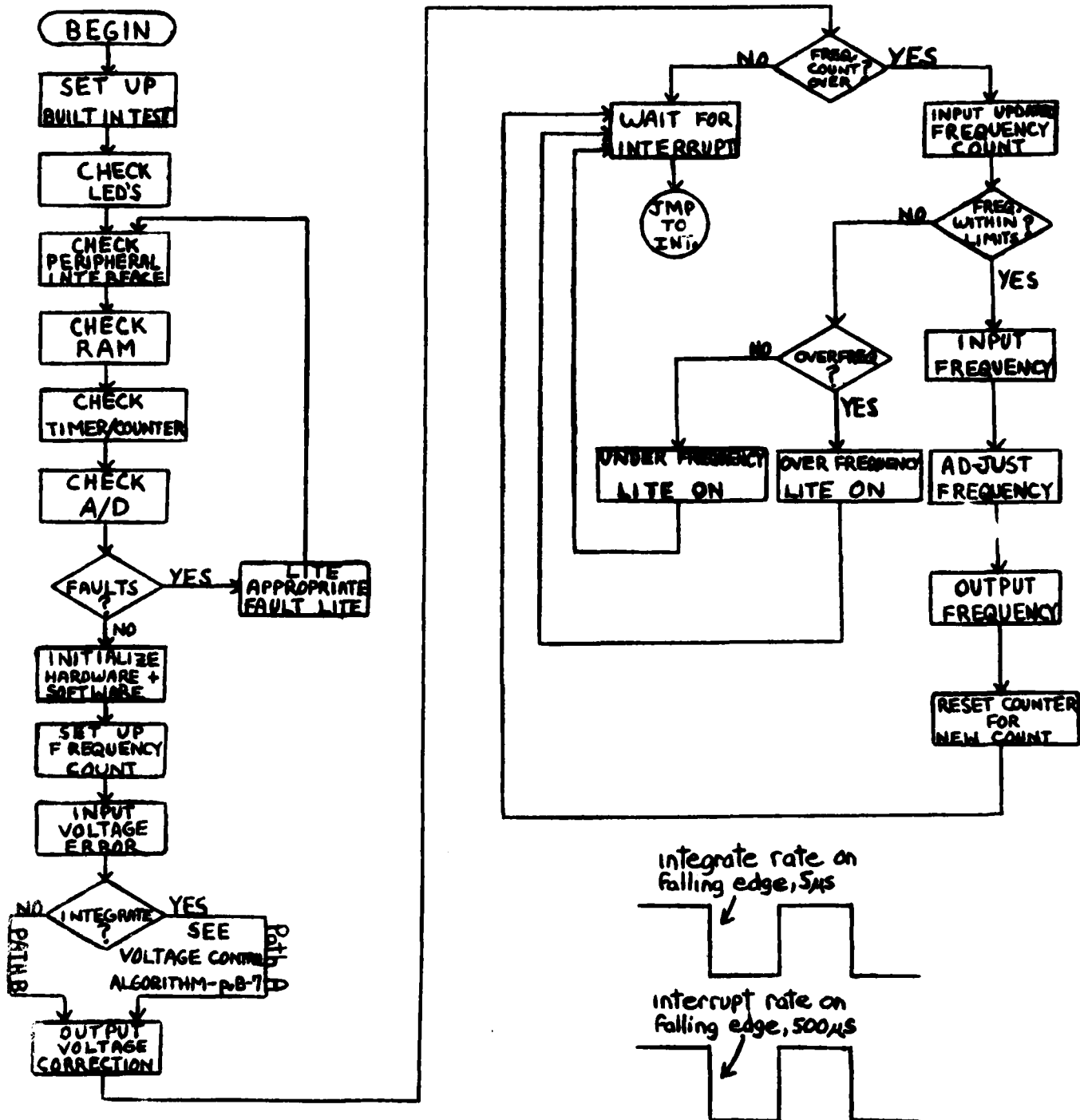
B-7. CONTROL SYSTEM PROGRAM LISTING

LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT	
0038		0	ORG	38H
0038	3EB0	1	MVI	A,0B0H
003A	D3E6	2	OUT	0E6H
003C	3EF0	3	MVI	A,0F0H
003E	D3E6	4	OUT	0E6H
0040	3EE0	5	MVI	A,0E0H
0042	D3E6	6	OUT	0E6H
0044	3EF0	7	MVI	A,0F0H
		8		
0046	D3E6	9	OUT	0E6H
0048	3EEF	10	MVI	A,0EFH
004A	D3C0	11	OUT	0C0H
004C	78	12	MOV	A,B
004D	D3C3	13	OUT	0C3H
004F	3E6F	14	MVI	A,6FH
0051	D3C0	15	OUT	0C0H
0053	7C	16	MOV	A,H
0054	D3C1	17	OUT	0C1H
0056	DBE6	18	IN	0E6H
0058	E602	19	ANI	02H
005A	DBE5	20	IN	0E5H
005C	EB	21	XCHG	

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LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT
005D	CA8D01	22	JZ SUB1
0060	C680	23	ADI 80H
0062	4F	24	MOV C,A
0063	7D	25	MOV A,L
0064	F27600	26	JP P80
0067	A7	27	ANA A
0068	F29D00	28	JP P81
006B	CDDA01	29	CALL MMULT
006E	FAA000	30	JM P83
0071	0600	31	MVI B,0
0073	C3A900	32	JMP TTMR
0076	A7	33	P80: ANA A
0077	FA8500	34	JM P881
007A	CDE901	35	CALL PMULT
007D	F2A000	36	JP P83
0080	06FE	37	MVI B,0FEH
0082	C3A900	38	JMP TTMR
0C85	CDE901	39	P881: CALL PMULT
0088	C680	40	ADI 80H
008A	FEFF	41	CPI OFFH
008C	C2A800	42	JNZ TMR
008F	3D	43	DCR A
0090	47	44	MOV B,A
0091	E8	45	XCHG

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LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT
0092	DBE6	46	IN OE6H
0094	E604	47	ANI 4H
0096	C2B900	48	JNZ CHECK
0099	57	49	MOV D,A
009A	C37E01	50	JMP INT
009D	CDDA01	51	P81: CALL MMULT
00A0	C680	52	P83: ADI 80H
00A2	FEFF	53	NZI: CPI OFFH
00A4	C2A800	54	JNZ TMR
00A7	3D	55	DCR A
00A8	47	56	TMR: MOV B,A
00A9	EB	57	TTMR: XCHG
00AA	DBE6	58	IN OE6H
00AC	E60H	59	ANI 4H
00AE	C2B900	60	JNZ CHECK
00B1	57	61	MOV D,A
00B2	3E40	62	MVI A,40H
00B4	D3EA	63	OUT OEAH
00B6	C37E01	64	JMP INT
00B9	7A	65	CHECK: MOV A,D
00BA	A7	66	ANA A
00BB	C27E01	67	JNZ INT
00BE	14	68	INR D
00BF	DBC2	69	IN 0C2H

LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
00C1	4F	70		MOV	C,A
00C2	DBC2	71		IN	0C2H
00C4	FEFB	72		CPI	0FBH
00C6	CADD00	73		JZ	F1
00C9	D2D400	74		JNC	F2
00CC	3E45	75		MVI	A,45H
00CE	D3EA	76		OUT	0EAH
00D0	AF	77		XRA	A
00D1	C37101	78		JMP	TMR2
00D4	3E46	79	F2:	MVI	A,46H
00D6	D3EA	80		OUT	0EAH
00D8	3EFE	81		MVI	A,0FEH
00DA	C37101	82		JMP	TMR2
00DD	3E80	83	F1:	MVI	A,80H
00DF	81	84		ADD	C
00E0	4F	85		MOV	C,A
00E1	F25101	86		JP	F3
00E4	95	87		SUB	L
00E5	F20301	88		JP	F72
00E8	69	89	F91:	MOV	L,C
00E9	FEF0	90		CPI	0F0H
00EB	DA1801	91		JC	FTEST1
00EE	17	92		RAL	
00EF	3F	93		CMC	

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LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT		
00F0	17	94		RAL	
00F1	3F	95		CMC	
00F2	17	96		RAL	
00F3	67	97	F93:	MOV	H,A
00F4	79	98	F993:	MOV	A,C
00F5	FEC0	99		CPI	0C0H
00F7	DA1801	100		JC	FTEST1
00FA	17	101		RAL	
00FB	84	102		ADD	H
00FC	FA6901	103		JM	F52
00FF	AF	104		XRA	A
0100	C37101	105		JMP	TMR2
0103	69	106	F72:	MOV	L,C
0104	FE10	107		CPI	10H
0106	D23201	108		JNC	FT22
0109	07	109		RLC	
010A	17	110		RAL	
010B	17	111		RAL	
010C	67	112		MOV	H,A
010D	79	113	F772:	MOV	A,C
010E	FEC0	114		CPI	0C0H
0110	DA2101	115		JC	FTST1
0113	17	116		RAL	
0114	84	117		ADD	H

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
0115	C36901	118		JMP	F52
0118	AF	119	FTEST1:	XRA	A
0119	C37101	120		JMP	TMR2
011C	3EFE	121	FTEST2:	MVI	A,0FEH
011E	C37101	122		JMP	TMR2
0121	3E80	123	FTST1:	MVI	A,80H
0123	84	124		ADD	H
0124	C36901	125		JMP	F52
0127	3E7F	126	FTST2:	MVI	A,7FH
0129	84	127		ADD	H
012A	C36901	128		JMP	F52
012D	2680	129	FT11:	MVI	H,80H
012F	C36101	130		JMP	F33
0132	267F	131	FT22:	MVI	H,7FH
0134	C30D01	132		JMP	F772
0137	69	133	F9:	MOV	L,C
0138	FE10	134		CPI	10H
013A	D21C01	135		JNC	FTEST2
013D	07	136		RLC	
013E	17	137		RAL	
013F	17	138		RAL	
0140	67	139		MOV	H,A
0141	79	140	F99:	MOV	A,C
0142	FE40	141		CPI	40H

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
0144	D21C01	142		JNC	FTEST2
0147	07	143		RLC	
0148	84	144		ADD	H
0149	F26901	145		JP	F52
014C	3EFE	146		MVI	A,OFEH
014E	C37101	147		JMP	TMR2
0151	95	148	F3:	SUB	L
0152	F23701	149		JP	F9
0155	69	150		MOV	L,C
0156	FEFO	151		CPI	OFOH
0158	DA2D01	152		JC	FT11
015B	17	153		RAL	
015C	3F	154		CMC	
015D	17	155		RAL	
015E	3F	156		CMC	
015F	17	157		RAL	
0160	67	158		MOV	H,A
0161	79	159	F33:	MOV	A,C
0162	FE40	160		CPI	40H
0164	D22701	161		JNC	FTST2
0167	07	162		RLC	
0168	84	163		ADD	H
0169	C680	164	F52:	ADI	80H
016B	FEFF	165	D1:	CPI	OFFH

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LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT		
016D	C27101	166		JNZ	TMR2
0170	3D	167		DCR	A
0171	67	168	TMR2:	MOV	H,A
0172	3E8F	169		MVI	A,8FH
0174	D3C0	170		OUT	0C0H
0176	3EA0	171		MVI	A,0A0H
0178	D3C2	172		OUT	0C2H
017A	3EF6	173		MVI	A,0F6H
017C	D3C2	174		OUT	0C2H
		175			
017E	FB	176	INT:	EI	
017F	F1	177		POP	PSW
0180	76	178		HLT	
0181	210040	179	BEGIN:	LXI	H,4000H; START
		180			
0184	F9	181		SPHL	
0185	F5	182		PUSH	PSW
0186	3EFE	183		MVI	A,0FEH
0188	67	184		MOV	H,A
0189	57	185		MOV	D,A
018A	C37F01	186		JMP	INT
018D	C680	187	SUB1:	ADI	80H
018F	4F	188		MOV	C,A
0190	7D	189		MOV	A,L

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
0191	F2BE01	190		JP	P3
0194	A7	191		ANA	A
0195	F2A301	192		JP	P92
0198	81	193		ADD	C
0199	FAA701	194		JM	P91
019C	2E80	195		MVI	L,80H
019E	0600	196		MVI	B,0
01A0	C3A900	197		JMP	TTMR
01A3	81	198	P92:	ADD	C
01A4	F2D601	199		JP	P95
01A7	6F	200	P91:	MOV	L,A
01A8	CDDA01	201		CALL	MMULT
01AB	FAA000	202		JM	P83
01AE	0600	203		MVI	B,0
01B0	C3A900	204		JMP	TTMR
01B3	81	205	P32:	ADD	C
01B4	F2C601	206		JP	P9
		207			
01B7	2E7F	208		MVI	L,7FH
01B9	06FE	209		MVI	B,0FEH
01BB	C3A900	210		JMP	TTMR
01BE	A7	211	P3:	ANA	A
01BF	F2B301	212		JP	P32
01C2	81	213		ADD	C

LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
01C3	FAD201	214		JM	P995
01C6	6F	215	P9:	MOV	L,A
01C7	CDE901	216		CALL	PMULT
01CA	F2A000	217		JP	P83
01CD	06FE	218		MVI	B,0FEH
01CF	C3A900	219		JMP	TTMR
01D2	6F	220	P995:	MOV	L,A
01D3	C38500	221		JMP	P881
01D6	6F	222	P95:	MOV	L,A
01D7	C39D00	223		JMP	P81
01DA	79	224	MMULT:	MOV	A,C
01DB	FEFB	225		CPI	0FBH
01DD	DAFB01	226		JC	TEST1
01E0	17	227		RAL	
01E1	3F	228		CMC	
01E2	17	229		RAL	
01E3	3F	230		CMC	
01E4	17	231		RAL	
01E5	3F	232		CMC	
01E6	C3F201	233		JMP	M4
01E9	79	234	PMULT:	MOV	A,C
01EA	FE06	235		CPI	6H
01EC	D2F701	236		JNC	TEST2
01EF	07	237		RLC	

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
01F0	17	238		RAL	
01F1	17	239		RAL	
01F2	4F	240	M4:	MOV	C,A
01F3	17	241		RAL	
01F4	81	242		ADD	C
01F5	85	243		ADD	L
01F6	C9	244		RET	
01F7	3E7F	245	TEST2:	MVI	A,7FH
01F9	85	246		ADD	L
01FA	C9	247		RET	
01FB	3E80	248	TEST1:	MVI	A,80H
01FD	85	249		ADD	L
01FE	C9	250		RET	
01FF	3E80	251	LED:	MVI	A,80H
0201	D3EB	252		OUT	OEBH
0203	3E40	253		MVI	A,40H
0205	210040	254	L1:	LXI	H,4000H
0208	F9	255		SPHL	
0209	D3EA	256		OUT	OEAH
020B	0E04	257		MVI	C,4H
020D	CDD902	258		CALL	DELAY
0210	DBEA	259		IN	OEAH
0212	3C	260		INR	A
0213	FE48	261		CPI	48H

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT
0215	C20502	262		JNZ L1
0218	3E83	263		MVI A,83H
021A	D3E7	264		OUT 0E7H
021C	3E80	265		MVI A,80H
021E	D3EB	266		OUT 0EBH
0220	3E55	267	L2:	MVI A,55H
0222	D3E4	268	P2:	OUT 0E4H
0224	D3E8	269		OUT 0E8H
0226	D3E9	270		OUT 0E9H
0228	D3EA	271		OUT 0EAH
022A	5F	272		MOV E,A
022B	DBE4	273		IN 0E4H
022D	BB	274		CMP E
022E	C24D02	275		JNZ P8
0231	DBE8	276		IN 0E8H
0233	BB	277		CMP E
0234	C24D02	278		JNZ P8
0237	DBE9	279		IN 0E9H
0239	BB	280		CMP E
023A	C24D02	281		JNZ P8
023D	DBEA	282		IN 0EAH
023F	BB	283		CMP E
0240	C24D02	284		JNZ P8
0243	FEAA	285		CPI 0AAH

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT
0245	CA6502	286		JZ P1
0248	3EAA	287		MVI A,0AAH
024A	C32202	288		JMP P2
024D	3E41	289	P8:	MVI A,41H
024F	D3EA	290		OUT 0EAH
0251	0E03	291		MVI C,3H
0253	CDD902	292		CALL DELAY
0256	C36502	293		JMP P1
0259	3E43	294	T8:	MVI A,43H
025B	D3EA	295		OUT 0EAH
025D	0E03	296		MVI C,3H
025F	CDD902	297		CALL DELAY
0262	C37902	298		JMP P4
0265	3EEF	299	P1:	MVI A,0EFH
0267	D3C0	300		OUT 0C0H
0269	D3C3	301		OUT 0C3H
026B	DBC3	302		IN 0C3H
026D	FEEF	303		CPI 0EFH
026F	3E6F	304		MVI A,6FH
0271	D3C0	305		OUT 0C0H
0273	D3C1	306		OUT 0C1H
0275	DBC1	307		IN 0C1H
0277	FE6F	308		CPI 6FH
0279	21FF3B	309	P4:	LXI H,3BFFH

LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT	
027C	23	310	R1:	INX	H
027D	4E	311		MOV	C,M
027E	79	312		MOV	A,C
027F	2F	313		CMA	
0280	77	314		MOV	M,A
0281	7E	315		MOV	A,M
0282	2F	316		CMA	
0283	91	317		SUB	C
0284	C2B602	318		JNZ	R8
0287	71	319		MOV	M,C
0288	7C	320		MOV	A,H
0289	DE3F	321		SBI	3FH
028B	C27C02	322		JNZ	R1
028E	7D	323		MOV	A,L
028F	DEFF	324		SBI	OFFH
0291	C27C02	325		JNZ	R1
0294	3EF0	326		MVI	A,OFOH
0296	D3E6	327		OUT	OE6H
0298	3EE0	328		MVI	A,OEOH
029A	D3E6	329		OUT	OE6H
		330			
029C	3EFG	331		MVI	A,OFOH
029E	D3E6	332		OUT	OE6H
02A0	DBE6	333		IN	OE6H

LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT
02A2	E601	334		ANI 1H
02A4	C2C202	335		JNZ AD8
02A7	0E01	336		MVI C,1H
02A9	CDD902	337		CALL DELAY
02AC	DBE6	338		IN 0E6H
02AE	E601	339		ANI 1H
02B0	CAC202	340		JZ AD8
02B3	C3CB02	341		JMP READY
02B6	3E42	342	R8:	MVI A,42H
02B8	D3EA	343		OUT 0EAH
02BA	0E03	344		MVI C,3H
02BC	CDD902	345		CALL DELAY
02BF	C3CB02	346		JMP READY
02C2	3E44	347	AD8:	MVI A,44H
02C4	D3EA	348		OUT 0EAH
02C6	0E03	349		MVI C,3H
02C8	CDD902	350		CALL DELAY
02CB	DBEA	351	READY:	IN 0EAH
02CD	E655	352		ANI 55H
02CF	C22002	353		JNZ L2
02D2	3E40	354		MVI A,40H
02D4	D3EA	355		OUT 0EAH
02D6	C38101	356		JMP BEGIN
02D9	21003F	357	DELAY:	LXI H,3F00H

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LOCATION	OP CODE	LINE NUMBER		SOURCE STATEMENT
02DC	71	358		MOV M,C
02DD	2C	359		INR L
02DE	3601	360		MVI M,1H
02E0	21003F	361	D5:	LXI H,3F00H
02E3	7E	362		MOV A,M
02E4	2C	363		INR L
02E5	96	364		SUB M
02E6	DA0B03	365		JC D8
02E9	2C	366		INR L
02EA	3601	367		MVI M,1H
02EC	3E04	368	D4:	MVI A,4H
02EE	21023F	369		LXI H,3F02H
		370		
02F1	96	371		SUB M
02F2	DA0603	372		JC D6
02F5	3EFA	373		MVI A,0FAH
02F7	060C	374		MVI B,0CH
		375		
02F9	48	376	D3:	MOV C,B
02FA	0D	377	D2:	DCR C
02FB	C2FA02	378		JNZ D2
02FE	3D	379		DCR A
02FF	C2F902	380		JNZ D3
0302	34	381		INR M

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LOCATION	OP CODE	LINE NUMBER	SOURCE STATEMENT
0303	C2EC02	382	JNZ D4
0306	2D	383 D6:	DCR L
		384	
0307	34	385	INR M
0308	C2E002	386	JNZ D5
030B	C9	387 D8:	RET
		388	
0038		389	END 38H

APPENDIX C

MICROCOMPUTER CONTROL SYSTEM HARDWARE

C-1. MICROCOMPUTER CONTROL BOARD

COMPONENT LIST

A1 – header

A2 – header

A3 – 741CJ

A4 – 7402

A5 – AH0126

A6 – header

A7 – 7400

A8 – 7400

A9 – MM5357

B1 – 1K resistor network chip

B2 – empty

B3 – empty

B4 – 7476

B5 – 7476

B6 – header

B7 – 54S04

B8 – 74S00

B9 – 8253

C1 – header

C2 – header

C3 – empty

C4 – MC1711

C5 – header

C6 – 54192

C7 – 54192

C8 – 54192

D1 – header

D2 – 3205

D3 – 74LS192

D4 – 74123

PIN ASSIGNMENTS

T1 - edge connector on microcomputer control board

J1, P1, P2 - connectors on Intel SBC 80/10 board

T1-1	+5V	T1-2	GND	T1-41	J-31	T1-42	P1-68
3	+12V	4	-	43	-	44	P1-67
5	-12V	6	-	45	-	46	P1-70
7	-5V	8	-	47	-	48	P1-69
9	-	10	frequency comparator circuit input	49	-	50	P1-72
11	J1-1	12	GND	51	-	52	P1-71
13	J1-3	14	A10-1 on 8010 board	53	-	54	P1-74
15	J1-5	16	A10-4 " " "	55	-	56	P1-73
17	J1-7	18	A10-13 " " "	57	-	58	P1-22
19	J1-9	20	A9-4 " " "	59	J1-49	60	P1-21
21	J1-11	22	Ready/Run Led	61	-	62	P1-58
23	J1-13	24	I/O LED	63	-	64	P1-57
25	J1-15	26	RAM LED	65	-	66	P1-23
27	-	28	TIMER LED	67	-	68	-
29	A4-12 on 8010 Board	30	A/D LED	69	-	70	Voltage Input
31	J1-21	32	Overspeed LED	71	-	72	-
33	J1-23	34	Underfrequency LED	73	-	74	Woodward Driver Circuit Input
35	J1-25	36	Program not running LED	75	-	76	-
37	-	38	P2-28	77	-	78	Field Driver Circuit Input
39	J1-29	40	A14-15 on 8010 board	79	+5V	80	GND

PARTS LIST

R1	5KΩ pot, 1/4 Watt	R23	120 Ω	C2	.01μf
R2	2.5 KΩ	R24	120 Ω	C3	180nf
R3	15.2 KΩ	R25	120 Ω	C4	.33μf, 1000V
R4	183 Ω	R26	120 Ω	C5	.0028μf
R5	2.0 KΩ	R27	120 Ω	D1	1N4001
R6	10 KΩ pot, 1/4 Watt	R28	120 Ω	D2	1N754
R7	10 KΩ	R29	160.75 KΩ	D3	1N4001
R8	1 KΩ	R30	1.5 KΩ pot, 1/4 Watt	D4	1N4001
R9	1 KΩ	R31	1 KΩ	D5	1N750
R10	1 KΩ	R32	1 KΩ	D6	1N750
R11	1 KΩ	R33	1 KΩ	D7	1N4001
R12	1 KΩ	R34	50Ω pot, 10 Watt	D8	1N4005
R13	1 KΩ	R35	47 KΩ	D9	1N4005
R14	1 KΩ	R36	1 KΩ	D10	1N4005
R15	220 KΩ	R37	1 KΩ	D11	1N4001
R16	47 KΩ	R38	10 KΩ	D12	1N4001
R17	2.2 KΩ	R39	10 KΩ	D13	1N249B
R18	2.2 KΩ	R40	3.3 KΩ	Q1	2N2222
R19	1 KΩ pot, 1/4 Watt	R41	688 Ω, 2 Watt	Q2	2N2222
R20	1 KΩ	R42	1 KΩ	Q3	2N2222
R21	120 Ω	R43	1.5 Ω, 150 Watt	Q4	2N3055
R22	120 Ω	C1	.1μf	Q5	2N2222
				Q6	2N3741
				Q7	2N6282

Various bypass capacitors of .1μf were used between +5V and GND.

WIRE LIST

FROM	TO	FROM	TO	FROM	TO
A1-4	A1-5	A4-10	B5-16	A7-8	T1-13
5	A1-9	11	A4-12,A5-13	9	A7-10
6	A1-7 .	13	A5-9	A7-11	T1-11
8	GND	14	+5V	12	A7-13
9	A2-4	A5-1	A5-7,A6-12	14	+5V
A2-2	A3-4,A2-5	10	GND	A8-1	A8-2
5	A2-3	11	+12V	3	T1-19
10	A3-10	12	-12V	4	A8-5
11	-12V	A6-1	B6-7	6	T1-21
12	A1-10	2	GND	7	GND
13	T1-70	3	T1-33	8	T1-23
A3-4	A2-5	4	+12V	9	A8-10
5	GND	6	B6-14,A6-10	11	T1-25
6	-12V	8	GND	12	A8-13
10	A5-8	12	A6-7	14	+5V
11	+12V	13	-12V	A9-1	A8-1
A4-1	A9-6	14	A9-12	2	A8-4
4	A4-11	A7-1	A7-2	3	A8-9
5	T1-41,A4-6	3	T1-17	4	A8-12
7	GND	4	A7-5	5	A6-9
8	A4-9,B5-4	6	T1-15	8	-12V
9	T1-31	7	GND	9	T1-35

FROM	TO	FROM	TO	FROM	TO
A9-10	+5V	B5-13	GND	B9-2	T1-44
13	A7-1	14	B5-12,A4-3	3	T1-46
14	A7-4	15	B5-9	4	T1-48
15	+5V	B6-1	B6-13	5	T1-50
16	A7-9	2	B6-3	6	T1-52
17	A7-12	6	-12V	7	T1-54
18	GND	8	GND	8	T1-56
B1-5	B7-2	11	+5V	10	C1-14
10	+5V	12	B6-4	11	B7-4
11	+5V	14	B6-9	12	GND
12	+5V	B7-1	GND	14	B7-11
13	T1-78	3	GND	15	A9-11
14	GND	4	B1-1	16	B7-8
15	+5V	6	B8-5,B1-2	17	T1-74
16	+5V	7	GND	18	B9-9
B4-1	T1-38	8	B1-6	19	T1-64
4	B4-16,C2-5	9	GND	20	T1-62
5	+5V	10	B1-7,T1-29	21	T1-40,B7-5
11	B9-9	11	C5-13	22	T1-60,B8-1
12	B4-9	14	+5V	23	T1-58,B8-2
13	GND	B8-3	B8-4	24	+5V
15	B4-6,A9-11	6	T1-66	C1-1	B1-3,B1-4
B5-1	B5-6,B4-15	7	GND	2	+5V
5	+5V	14	+5V	3	C1-4
11	A4-2	B9-1	T1-42	C2-7	+5V

FROM	TO	FROM	TO	FROM	TO
C2-8	B4-9	C7-8	GND	D2-1	T1-14
10	+5V	12	C8-5	2	T1-16
C4-2	GND	14	GND	3	T1-18
4	T1-7	16	+5V	4	GND
5	T1-10	C8-5	C7-12	5	GND
6	T1-12	8	GND	6	T1-20
9	B7-2	12	T1-59	8	GND
10	C5-1	14	GND	16	+5V
11	+12V	16	+5V	D3-5	C8-12
12	GND	D1-1	D2-15	8	GND
C5-3	C5-5	2	D2-14	12	D4-1
4	GND	3	D2-13	14	GND
6	T1-7	4	D2-12	16	+5V
7	GND	5	D2-11	D4-4	T1-39
8	C5-9,B9-14	6	D2-10	8	GND
9	C5-10	7	D2-9	14	C1-12
10	C5-13	8	D2-7	15	C1-4
11	+5V	9	T1-36	16	+5V,C1-11
14	+5V	10	T1-34		
C6-5	T1-38	11	T1-32		
8	GND	12	T1-30		
12	C7-5	13	T1-28		
14	GND	14	T1-26		
16	+5V	15	T1-24		
C7-5	C6-12	16	T1-22		

HEADER ASSEMBLIES

A1

1   14
2   13
3   12
4   11
   R1
5   10
   D1
6   9
   D2
7   8

A2

1   14
   R2
2   13
   R3
3   12
   R4
4   11
   R5
5   10
6   9
7   8

A6

   6   5
1   7   4   14
2   8   3   13
3   LF398   12
   9   2
4   11
5   10
   R6
6   9
   R7
7   8

B1

1   R8   16
2   R9   15
3   R10   14
4   R11   13
5   R12   12
6   R13   11
7   R14   10
8   9

B6

1   D3   14
2   D4   13
3   D5   12
4   D6   11
5   10
6   R15   9
7   C1   8

C1

1   14
  Q1
2   13
3   C2   12
4   R16   11
5   10
6   9
7   8

C2

1   14
2   13
3   12
4   11
5   R17   10
6   9
7   R18   8

C5

1   14
   Q2
2   13
3   12
4   R19   11
5   D7   10
6   R20   9
7   C3   8

D1

1   R21   16
2   R22   15
3   R23   14
4   R24   13
5   R25   12
6   R26   11
7   R27   10
8   R28   9
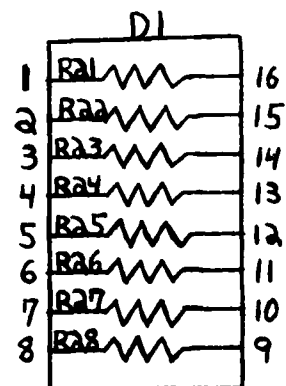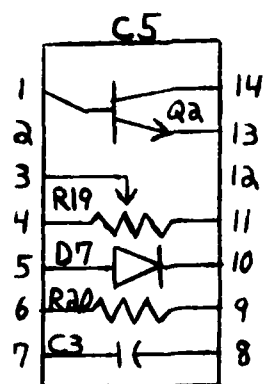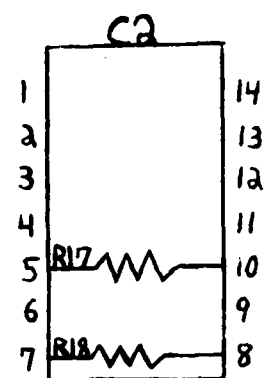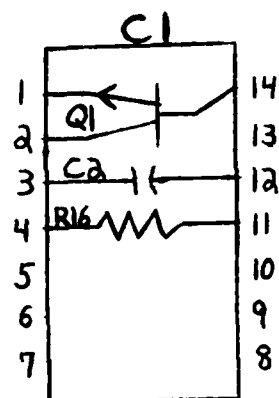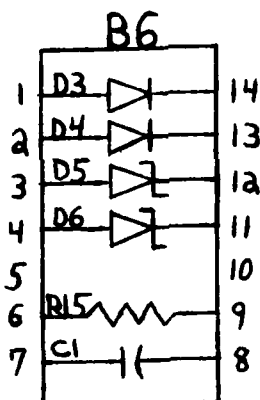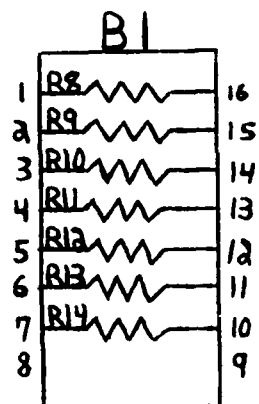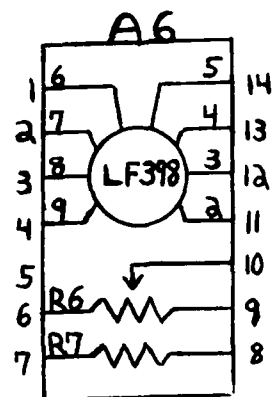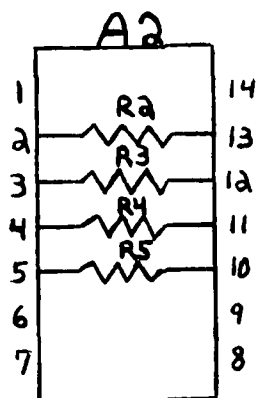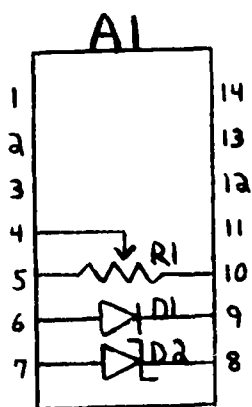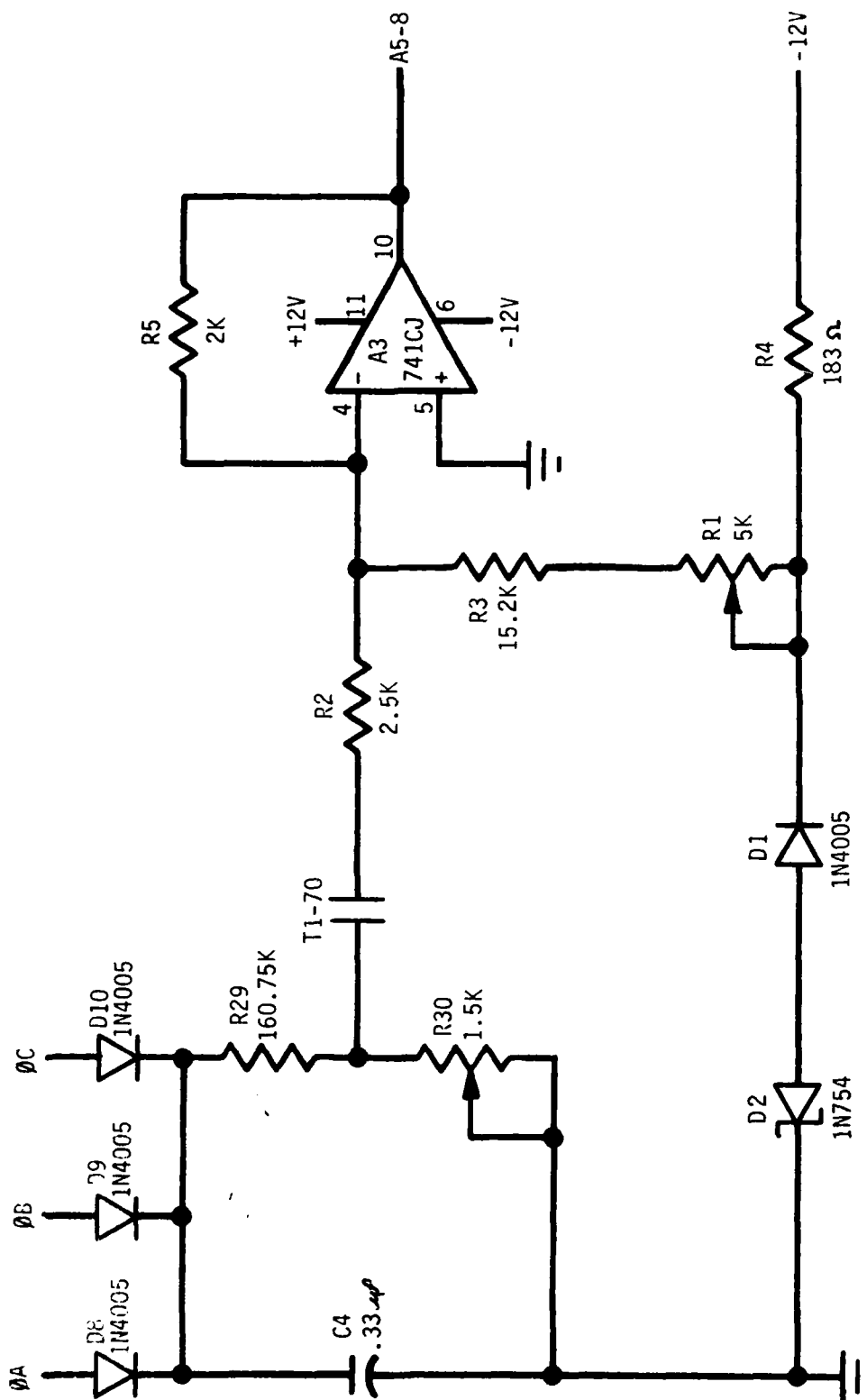
THREE PHASE VOLTAGE TO ANALOG SWITCH CIRCUIT
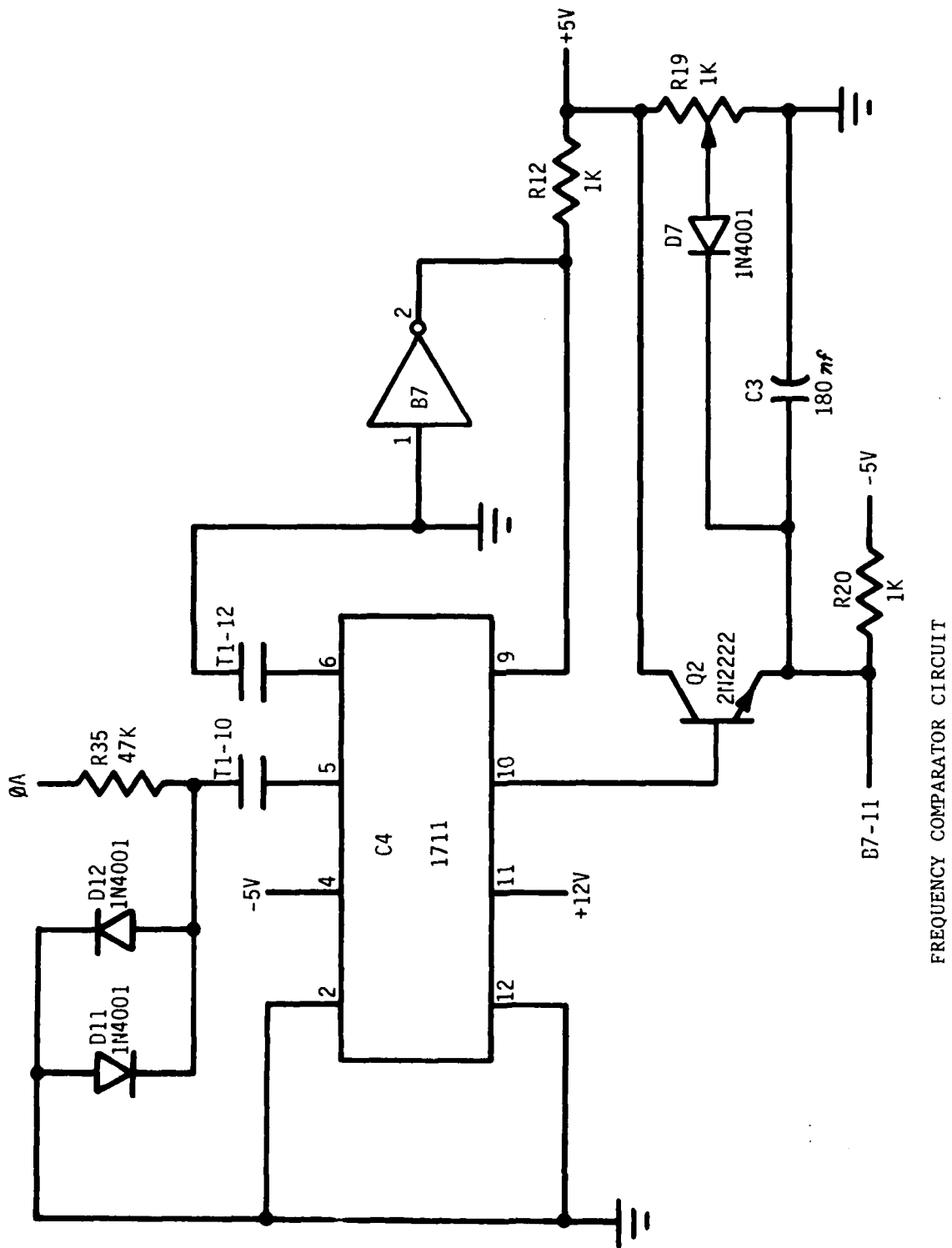
FREQUENCY COMPARATOR CIRCUIT
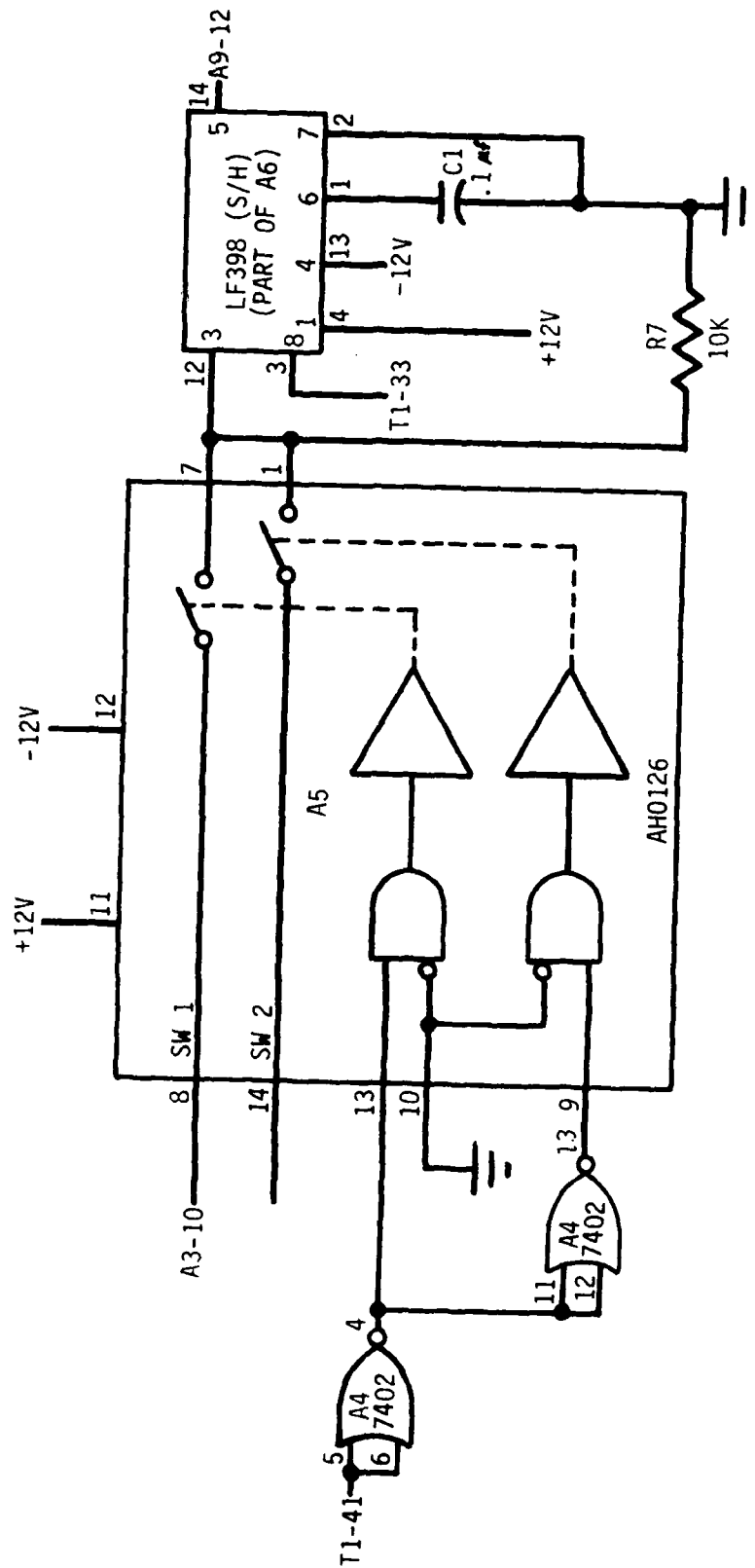
ANALOG SWITCH-SAMPLE AND HOLD CIRCUIT
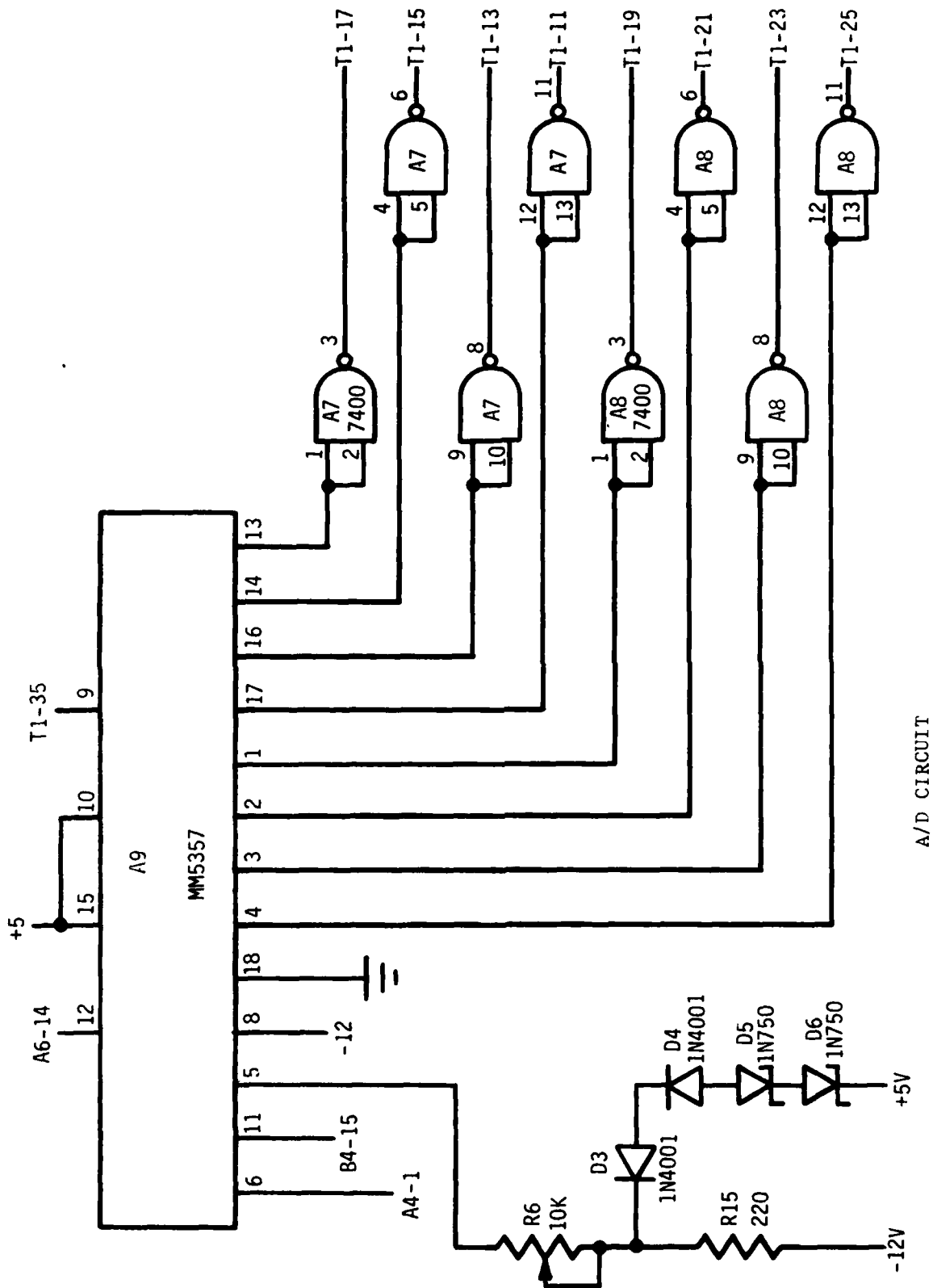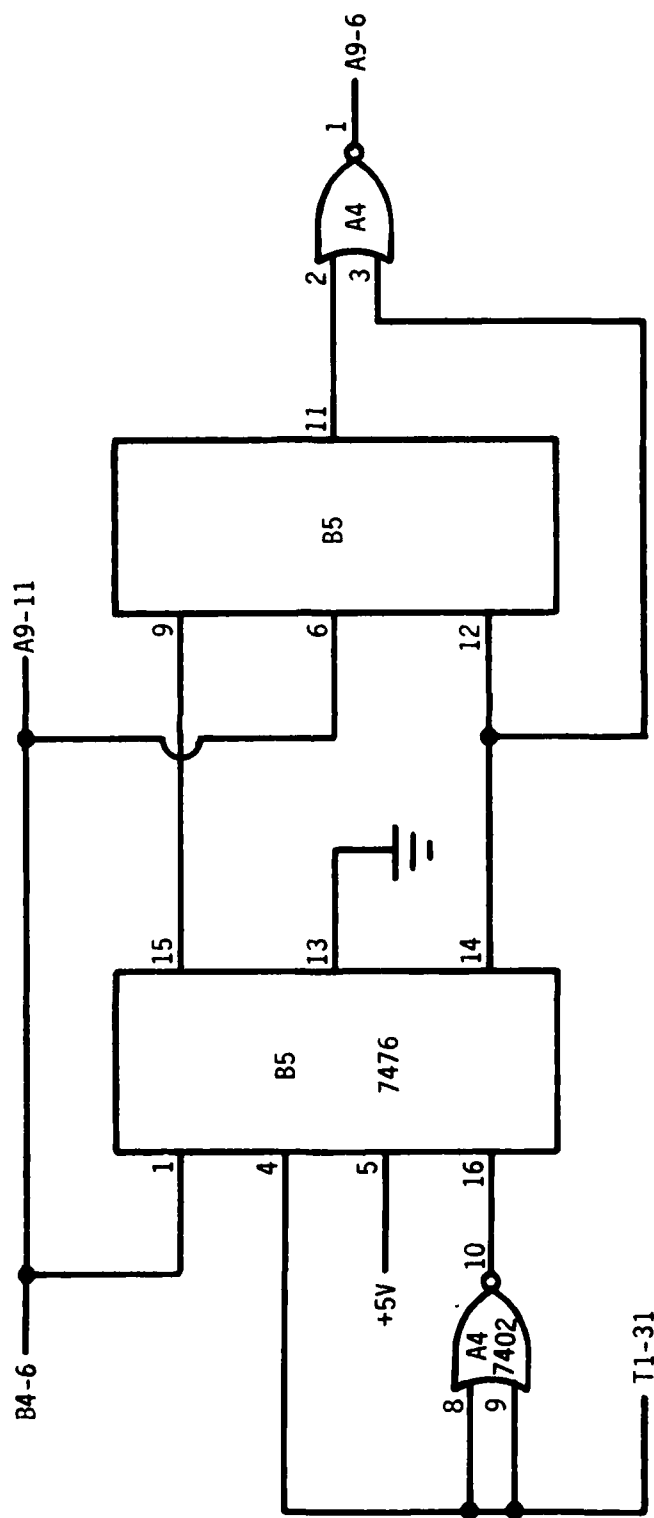
A/D CIRCUIT

CONVERT SIGNAL CIRCUIT FOR A/D
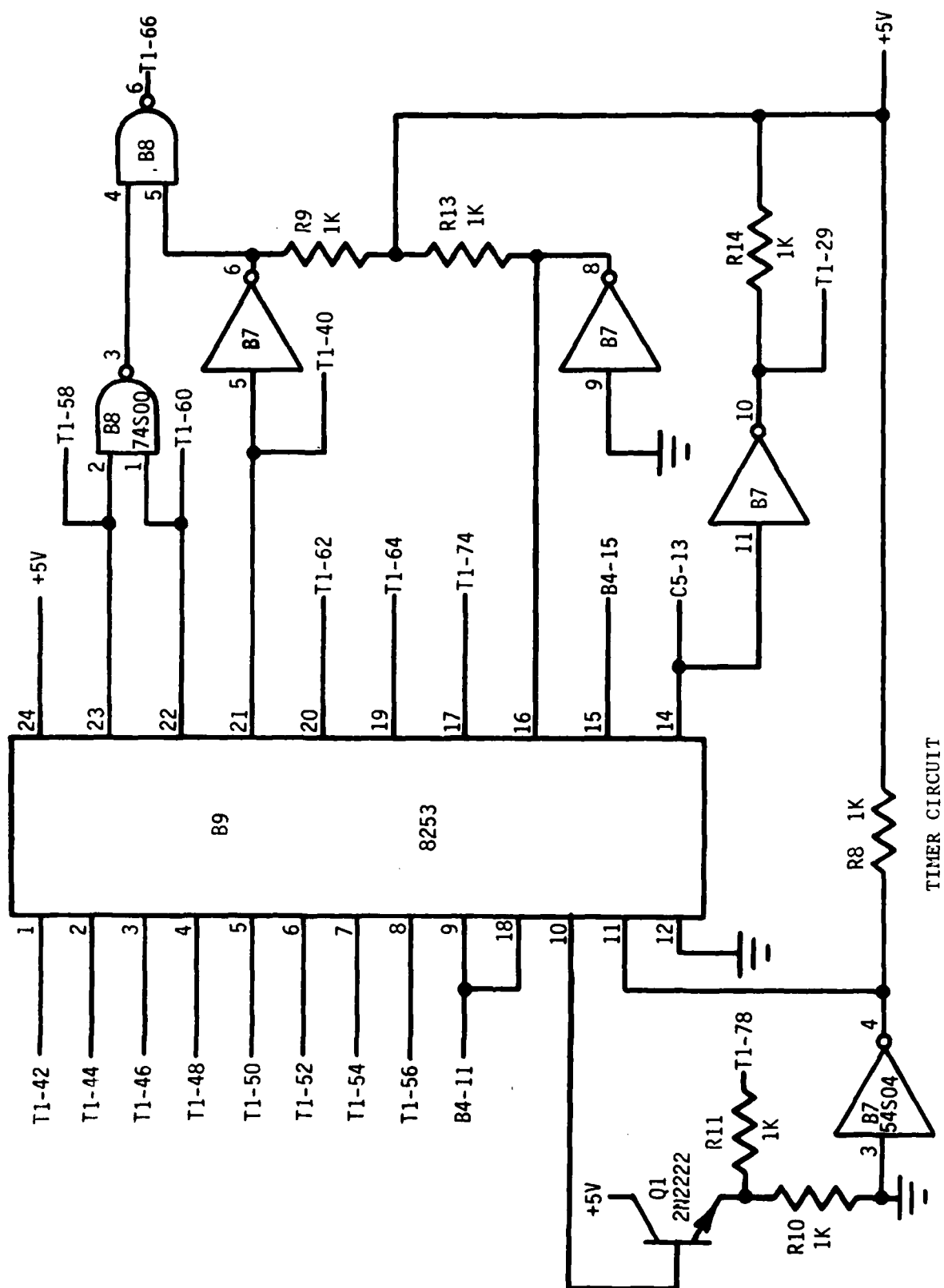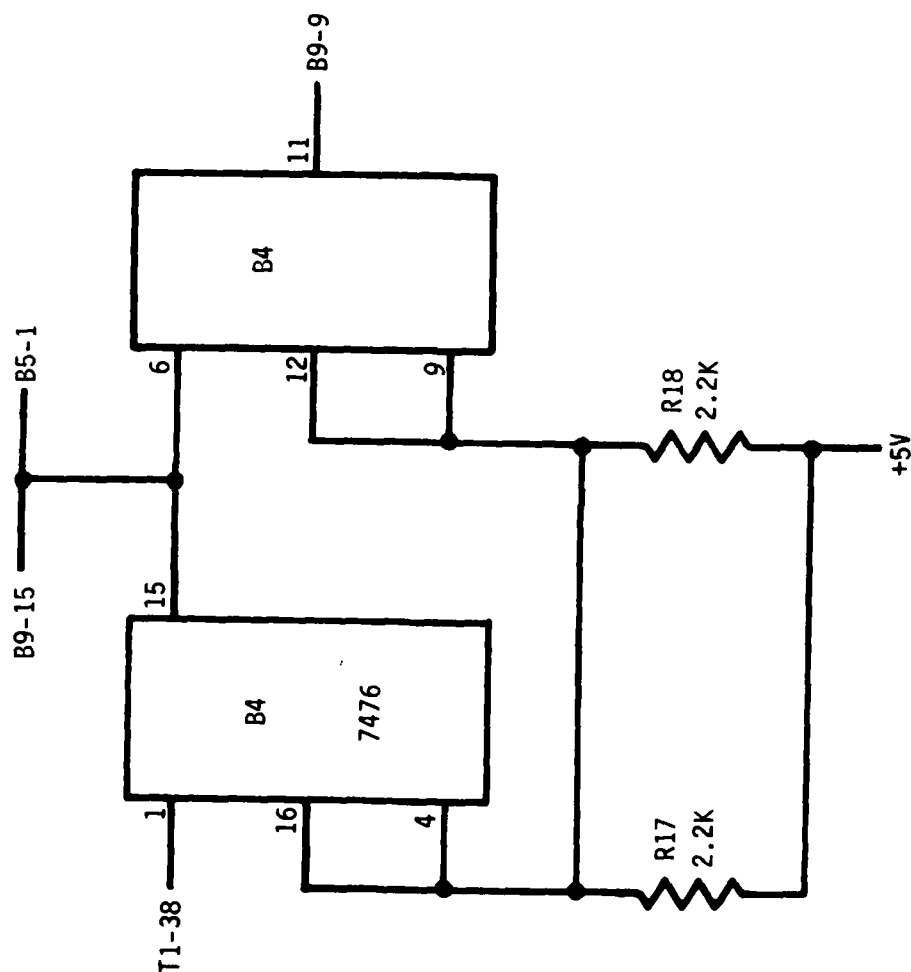
TIMER CIRCUIT

CLOCK SOURCE CIRCUIT
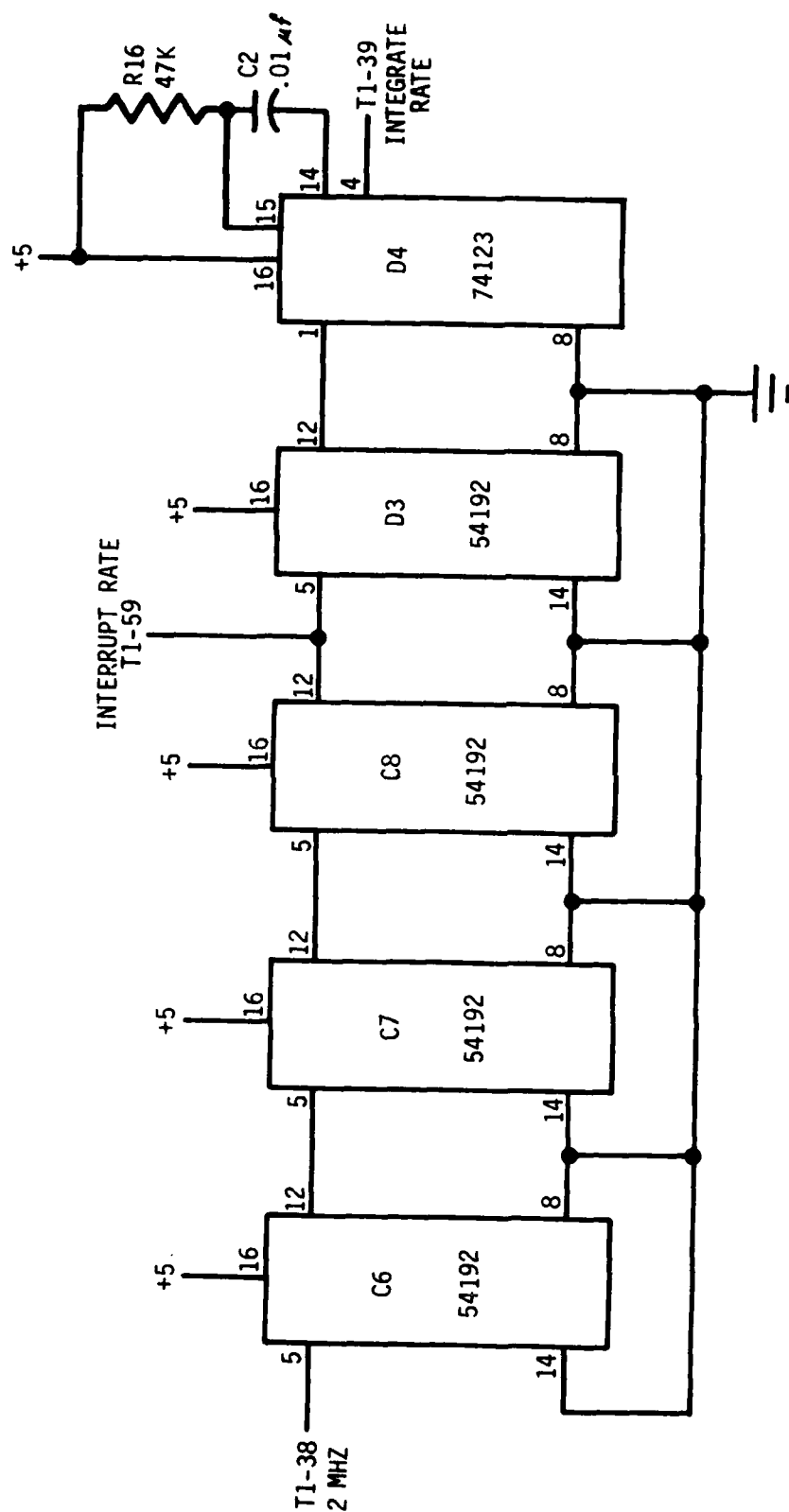
CLOCK FREQUENCY DIVIDER CIRCUIT
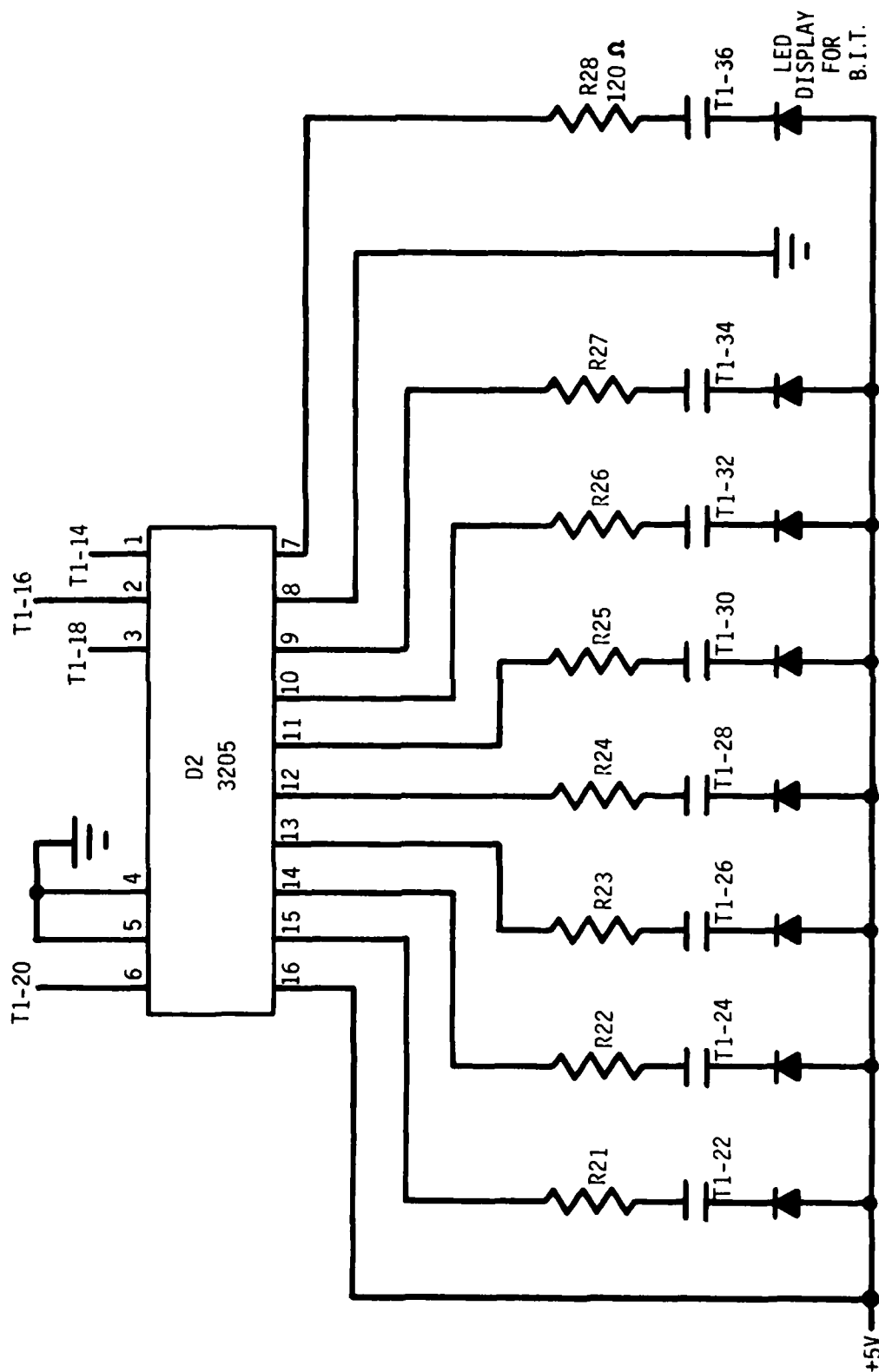
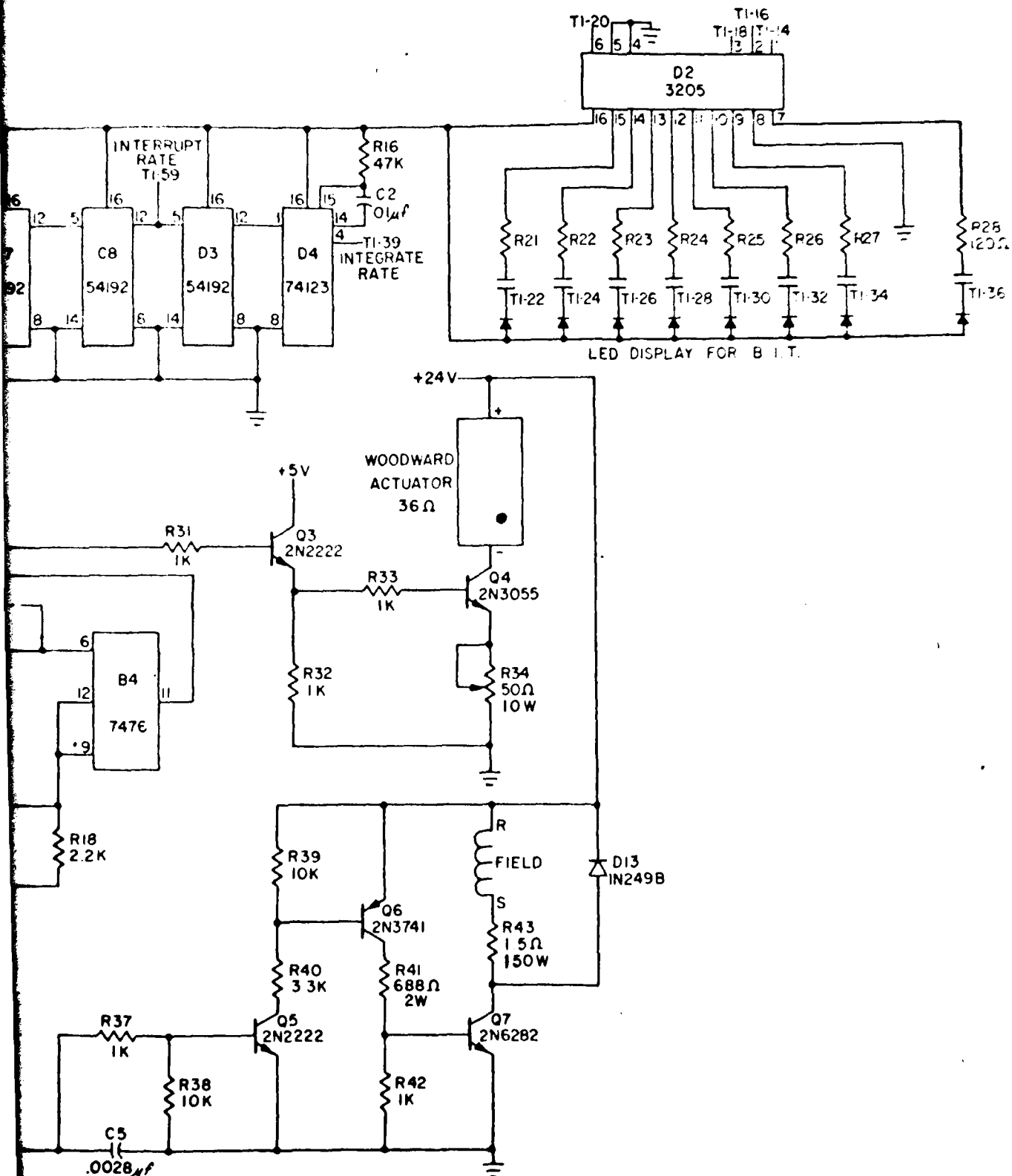1 OF 8 DECODER CIRCUIT FOR L E D DISPLAY
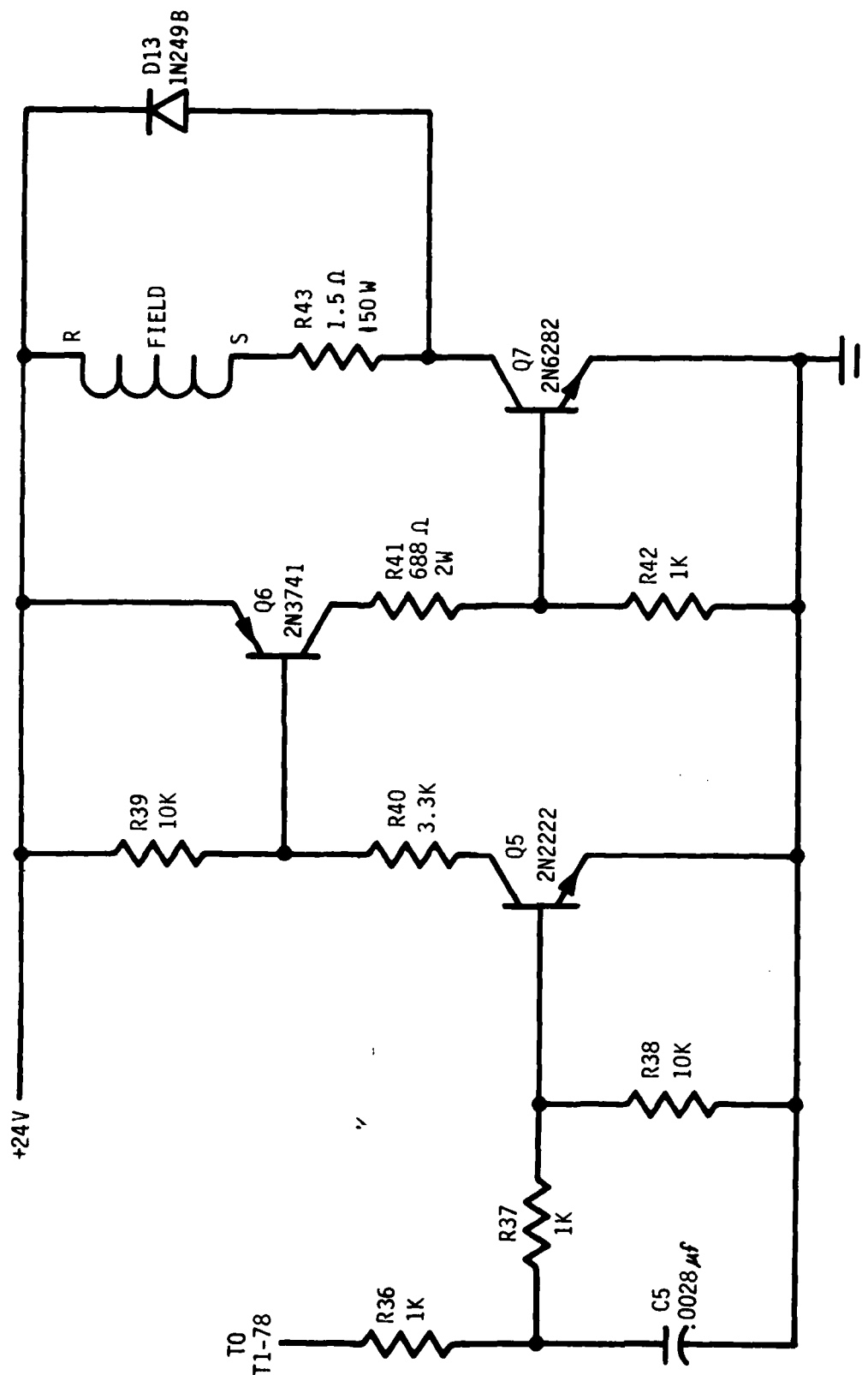
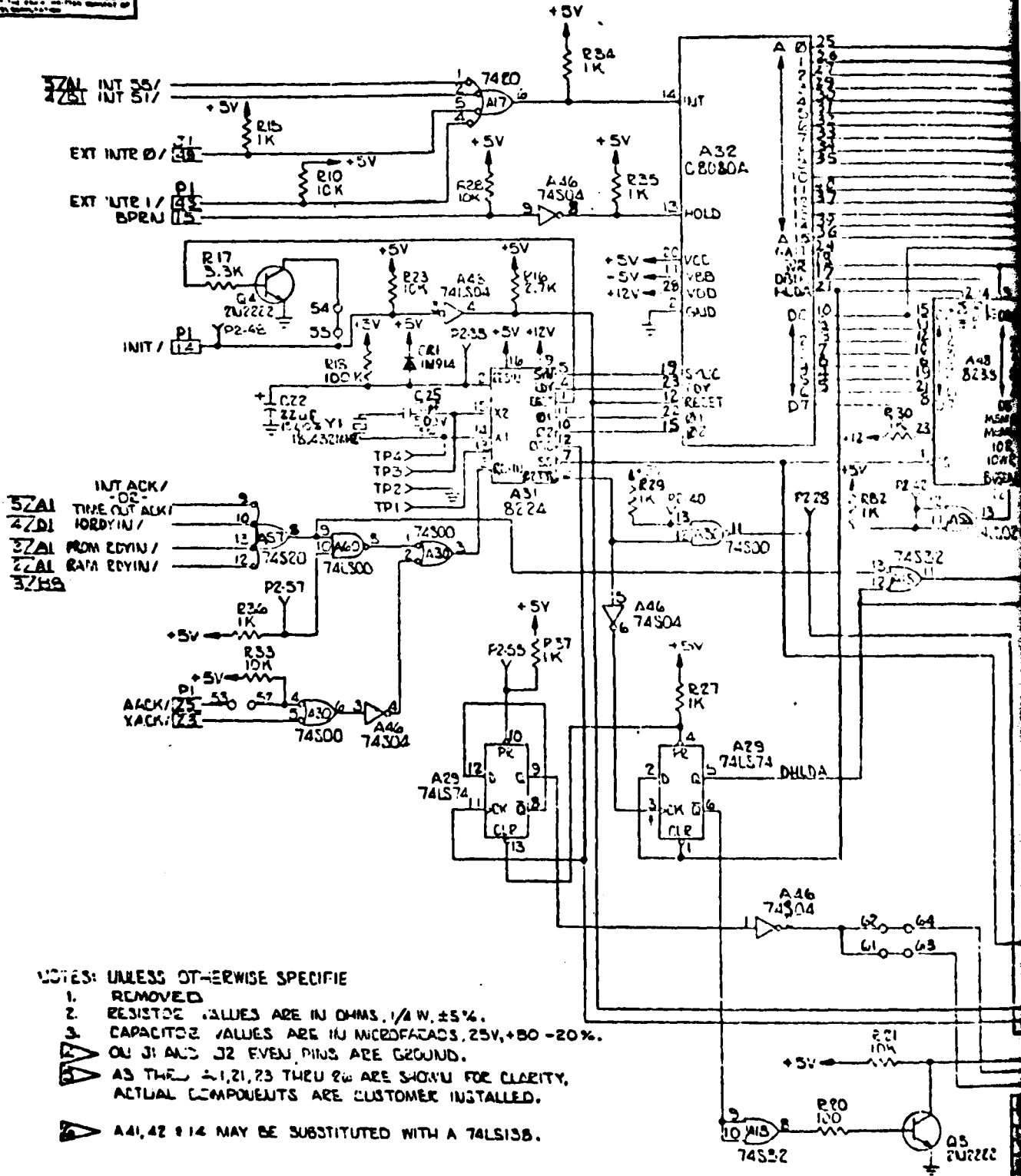FIELD DRIVER CIRCUIT
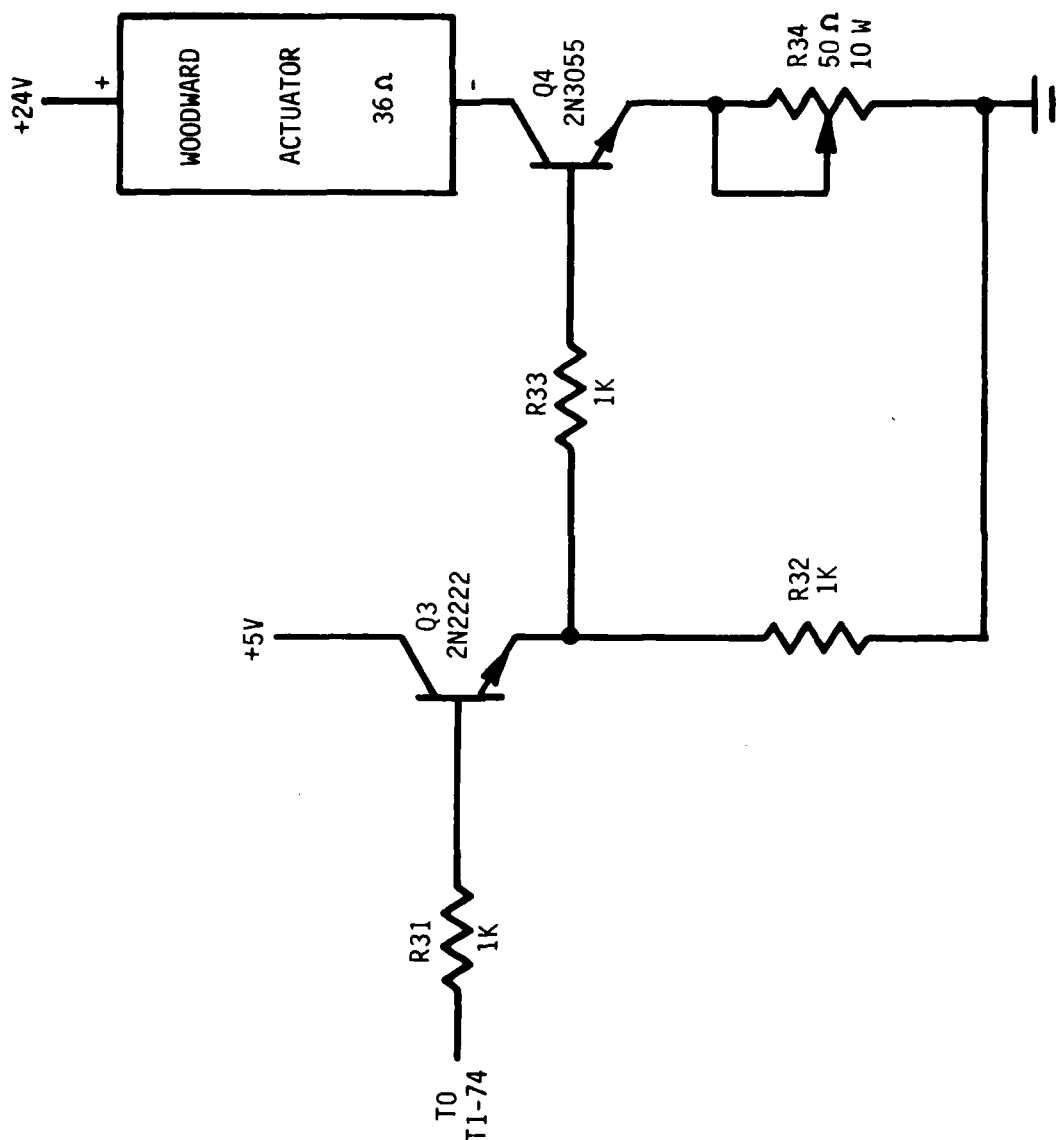
WOODWARD ACTUATOR DRIVER CIRCUIT

MICROCOMPUTER CONTROL BOARD

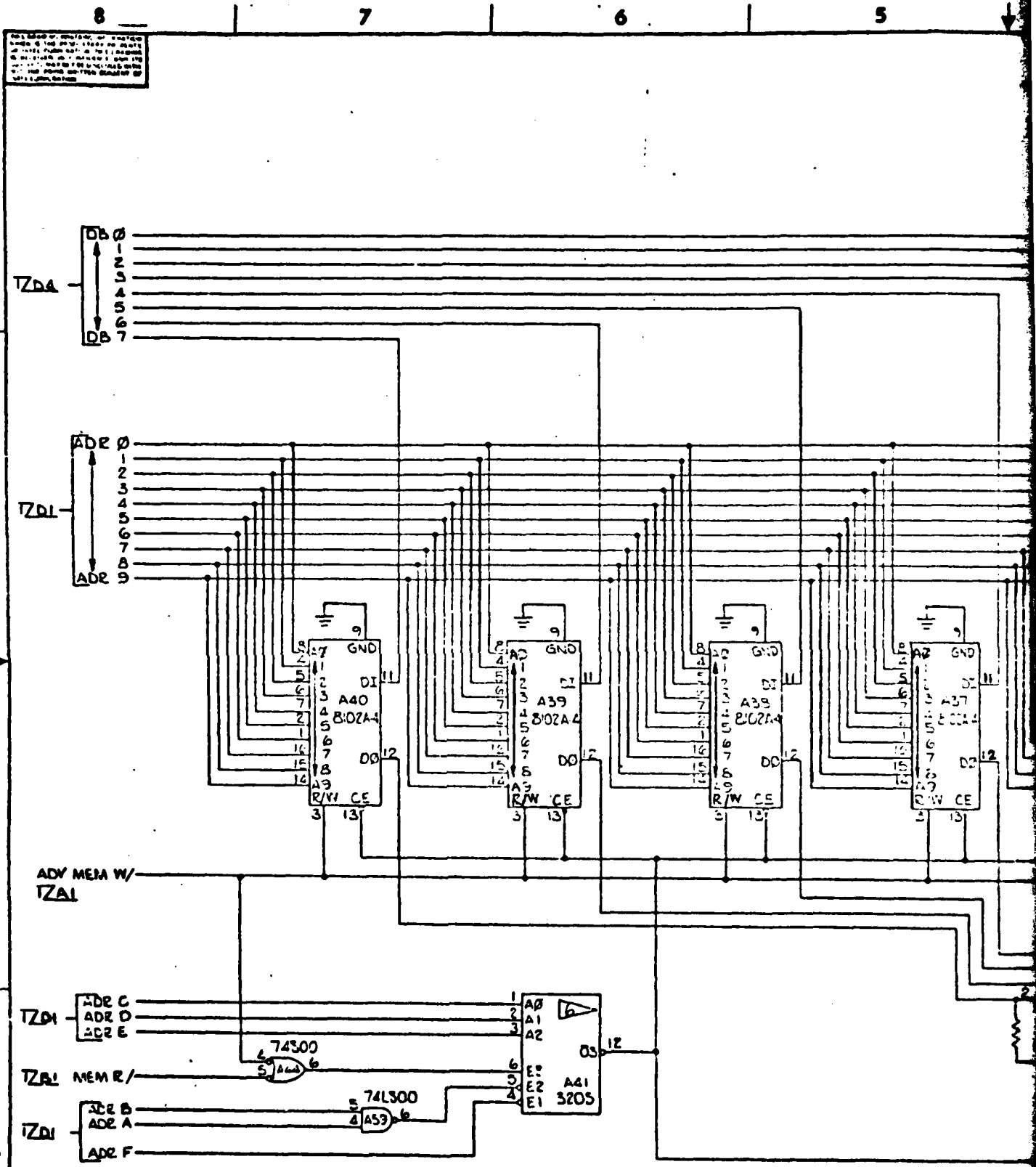264 (C-20 of C-25)

LED DISPLAY FOR B.I.T.

Schematic, SBC 80/10-B02λ-4

(C-25)

4   3   2   1

D

C

A2 GND
DI 11
A37
9102A
DO 12
C/W CE
3   13

A3 GND
DI 11
A36
9102A
DO 12
R/W CE
3   13

A2 GND
DI 11
A35
9102A
DO 12
R/W CE
3   13

A2 GND
DI 11
A34
9102A
DO 12
C/W CE
3   13

A3 GND
DI 11
A33
9102A
DO 12
C/W CE
3   13

B

DM 2
3
4
5
DM 7

37C1

RPS
12 K

+5V
1.6

EP4
12 K

+5V
1.6

P2-30

RAM RDY IN/
T2-8

A

8   7   6   5

+12V   +5V

673 +5V
65   66
C4
-5V

70   68   69
71   72

C28
.1

TZD1

ADR 0
1
2
3
4
5
6
7
8
ADR 9

+5V   24   19   21   PROM 0   +5V   24   19   21

A2   O1
1   2
2   3
A23   4
8708   5
6
7   OB
A9

A24
8708

CS
20

CS
20

+5V
R31
1K

+5V
RP3
1K

75
73   74

TZD1

ADR A
B
C
D
E
F
ADR E

76   78   9
8   A59   10   74LS00
77   74LS02   2   A59   2

8
2   A59   1
74LS02

A3
A1
A2

E3
E2
E1

A42
3205

TZCB   RAM RDY IN/

74LS04
5   6
A43

TZB1   NEMR/

74LS04
9   8
A43

JUMPER TABLE				
2716	66-67	69-70	74-75	77-78
2708	65-66	68-69	73-74	76-78

	A23	A24	A25	A26
2716	0-7FF	800-1FFF	1800-FFF	1800-1FFF
2708	0-3FF	400-7FF	800-BFF	C00-FFF

267

REVISIONS

LTR	DESCRIPTION	BY	CHK	ENGR
/	SEE SHEET 1.	Sundra		

D

PROM 1

PROM 2

+5V

PROM 3

A24 6705

A25

A26 8705

CS

CS

CS

DM Ø
1
2
3
4
5
6
DM 7

2ZB1

DBØ
1
2
3

DB2
DB3

A55
8216

CS DIEN
C1

OU BOARD

74LS00

74LS00

MEM CMD/

74S00

A48

DB4
5
6
DB7

A56
8216

+5V

R35
12K

CS DIEN
C1

FROM RDY IN/
TZGB

1ZD4

SCALE	SIZE	SHEET	DRAWING NO	REV
SHT 3 OF 5	D		2000351	C

57 (C-23 of C-25)

8   7   6   5

17D1 ADR0
17D1 ADR1
17A1 RESET
17A1 IOR/
17A1 IOW/
42D1 CS2/
47D1 CS1/

DB0
1
2
3
T2D4 4
5
6
DB7

+5V R19 1K 40 42 41 43

A1 8226 +5V RP

A2 8226 +5V EP2 1K

419 S255
PORT E4
A0
A1
RST
RD/
WR/
CS
D0
D1
D2
D3
D4
D5
D6
D7
PORT E6
PORT E5
GND

PA2
FA7
FC2
FC7
FB0
PB7

A3

A4

A6

A5

P1
-5V
+12V
-12V
+5V
GND

C61 22 10%,10% C48 .01 C26 .1 -5V

C59 15V 22 10% C7,47 50,65 .01 C25,27,29,31 .1 +12V

C63 15V 22 10% C8 .01 -12V

C60,62 22 15V 10% C9,11,13,14,20,21 32,54,43,45,49, 51,58,66,67 .01 C1-6,12,15-19, 55-39,41,42 .1 +5V

T2B1 STATUS STROBE
T2D1 CØ (8080)

269 (C-25 of
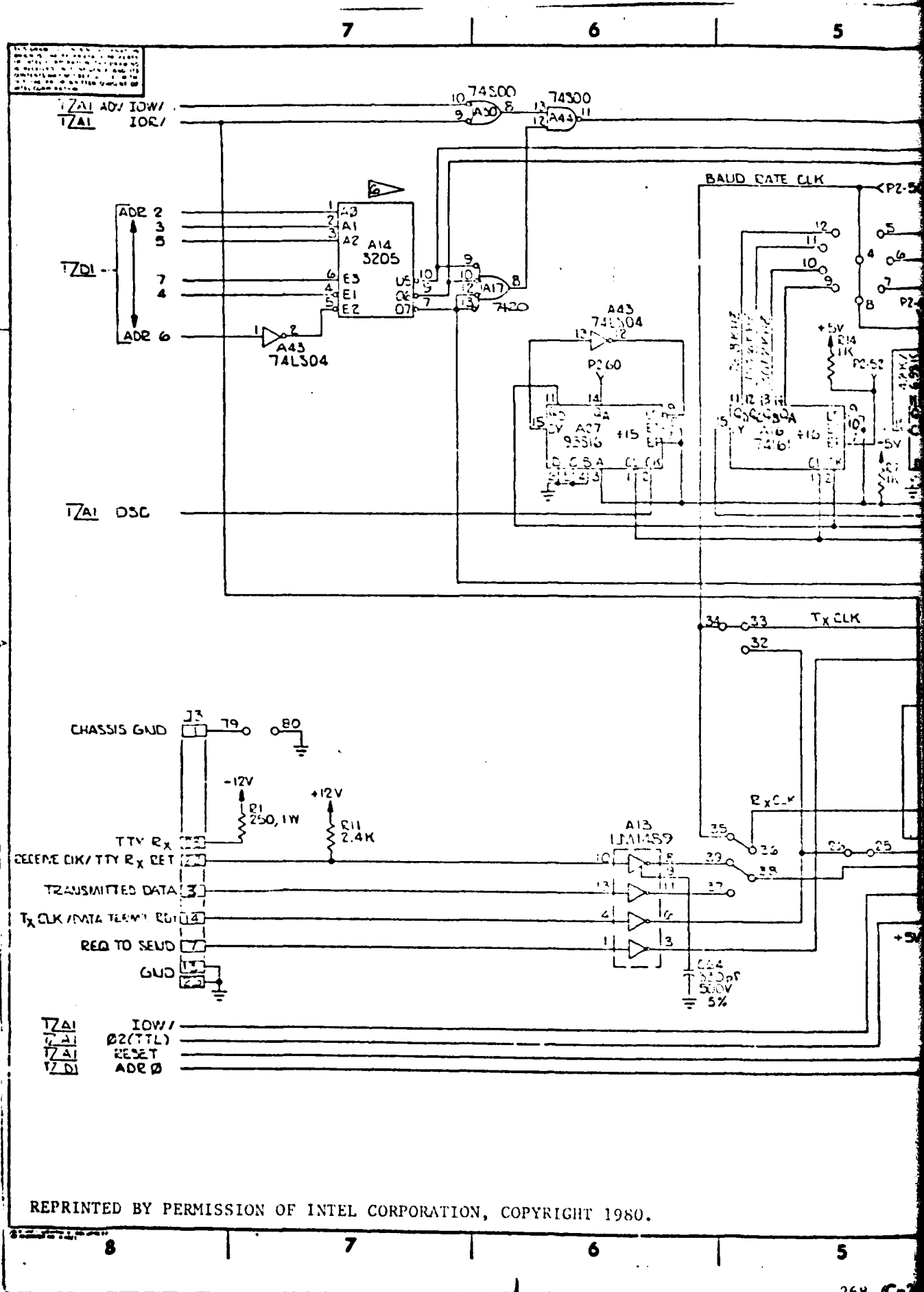
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APPENDIX D

VOLTAGE AND FREQUENCY REGULATION RESULTS

VOLTAGE REGULATION RESULTS

FREQUENCY REGULATION RESULTS

MICROCOPY RESOLUTION TEST CHART

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