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F O R E W O R D

↳ This bibliography cites research publications, with abstracts in English,

In this document you will find a list of abstracts of research publications issued up to August 1977 from the project *Prozeßlenkung mit Datenverarbeitungsanlagen - PDV^d (process control with computers). All reports cited, except three,

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K.H. Timmesfeld, B. Schürlein, P. Rieder, K. Pfeiffer, G. Müller,
K. Kreuter, P. Holleczeck, V. Haase, L. Frevert, P. Elzer, S. Eichen-
topf, B. Eichenauer, J. Brandes:
PEARL - A proposal for a process- and experiment automation realtime
language.

KFK-PDV 1

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 1, April 1973
198 pages, 24 figs., 29 refs.

A middle-level programming-language is described which allows to
formulate the structure, the algorithms, time behaviour and I/O of
realtime programs. It was developed by a group of German industrial
firms and research institutes and is intended for the process control
engineer or experimenter with some programming experience. The report
describes mainly the semantics of the language, but contains also app-
lication examples and an alphabetic list of the syntax formulas.

(out of print)

(DM 22,--)

R. Stimmelmayr: Evaluation of Literature Concerning Diagnosis of
Computersystems
Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 2, May 1973
10 pages, 51 refs.

KFK-PDV 2

The basic reports or studies of previous activities and results
achieved regarding the subject of computer diagnosis were selected
from a variety of papers and are collected in the appendix. The
common structure of the various methods and the possible modifi-
cations are demonstrated in a concised form.

(DM 5,--)

R. Wertmann decision table preprocessor for control systems
(systems design)

KFK-PDV 3

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 3, May 1973
75 pages, 11 figs., 16 tabs., 20 refs.

The study deals with the design of a decision table preprocessor for
process control systems. The range of possible applications for decision
tables will be shown, and in particular, the conversion technique itself.
Definite advantages are to be realized in the standardization and simpli-
fication of systems analysis, programming and documentation.
The conversion approach incorporates the matrix method and produces
programs in the PEARL programming language. In accordance with the
table criteria, a selection is made between the most applicable of
two expression methodes - bitstring or comparison operator.
Through control parameters the decision table can be explicitly retained
in matrix form (allowing table changes on-line).
After thorough syntax and semantic description of the preprocessor input,
the procedure will be illustrated with two objective applications.

(DM 10,--)

J. Nehmer Hardware Extended Executive Primitives for Process Control
Systems

KFK-PDV 4

Gesellschaft für Kernforschung mbH., Karlsruhe
Report KFK-PDV 4, Mai 1973
11 pages, 3 figs.

This report describes on the basis of a layer structure for process
control software the subdivision of the operating system nucleus into
classes of executive primitives which may be called by interruptroutines.

(DM 5,--)

H. Herbstreith, P. Kossmann:

KFK-PDV 5

Performance characteristics of today's process control computers

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 5, June 1973
25 pages, 8 figs., 3 refs.

This report reviews the state of the art in modern process computers. For this purpose a representative selection of 19 American and European process computers was examined. The most important characteristics of the central processor units have been determined and a comparative overview is given including a discussion of performance data and their statistical distribution.

By an additional investigation of 256 process computers operating during the past 7 years trends in the development of hardware features such as word length, cycle time, instruction set and addressing modes are shown.

(DM 10,--)

R. Werthmann, E. Kazis:
Interactive dialog system

KFK-PDV 6

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 6, July 1973
102 pages, 16 refs.

The essay deals with a Dialog System (IDIAL, Interactive Dialog System) to interface Process Data Processing with its Environment. The initial description covers several tasks and the main demands which such a Dialog System must fulfill. The various interface points are then presented and described. The interface point between Man and Dialog System will be especially in-depth. Relatedly, the proposed Dialog Language for the Dialog System IDIAL will be explained. In closing, several evaluations for the implementation of the system are to be presented.

(DM 10,--)

F. Quante:

KFK-PDV 7

Possibilities and limitations of automatic speech recognition for command input in control rooms.

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 7, July 1973
54 pages, 13 figs., 95 refs.

An analysis of the state of the art of automatic speech recognition shows, that the recognition of about 10 commands in control rooms is feasible at an error-rate of 10^{-3} and a reject rate of 10^{-1} . 45 recognition systems are briefly described. Improvements are not to be expected in the near future.

To fulfill its task, the speech recognition system must be speaker-adaptive, and the signal tracing has to be done in the presence of acoustic noise with a noise-cancelling microphone. As a starting-point for the application in control rooms a procedure with third octave filtering, time and amplitude normalization is described.

(DM 10,--)

H. Siebert:
Automatic Failure Diagnosis in Technical Processes

KFK-PDV 8

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 8, August 1973
20 pages, 68 refs.

This summary of literature is intended to be a base for further investigations in the field of failure diagnosis (detection and localization of faults) in technical processes, considering the use of process computers. We tried to obtain a general view of methods for process supervision, i.e. the detection of faults and the resulting steps to avoid damages. We used all bibliographical data we got notice of. This summary presents the state of July 1973; provably it is not complete.

(DM 5,--)

M. Rupp:
Hardware extended executive primitives for process control systems (2. intermediate report): executive primitives for working space management

KFK-PDV 9

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 9, July 1973
23 pages, 3 refs.

Three alternative realizations of executive primitives for the nucleus internal working space management are reviewed and discussed.

(DM 5,--)

P. Namneck, I. Schnarre, K. Wagner:
MULI - Multi Level Dialog System,
Multi Level Dialog Language - Description of language and system
Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK PDV 10, October 1973
147 pag., 2 fig.

KFK-PDV 10

Volume 1 (KFK-PDV 10) describes a machine and problem independent "Multi Level Dialog Language" and its implementation, the "Multi Level Dialog System". The system offers a choice of different language-levels, so that users with varying system knowledge have access to the same computer functions. The defined language may be modified and extended at any time, even during operation, for which no additional programming is required. The user has complete freedom in defining the computer action associated with a given input (i.e. with the semantics of this input). Furthermore the volume discusses the adaptation to a system (installation) and the adaptation to a selected problem (application) as well as possible subsets of the MULI-language and the MULI-system. This includes the definition of those parameters which are required to tailor a system to the special needs of a user.

Volume 2 (KFK-PDV 11) contains six case studies. For each of these studies a computer system is selected and the required specifications are given.

(DM 12,--)

P. Nanneck, I. Schnarre, K. Wagner:
MULI - Multi Level Dialog System,
Multi Level Dialog Language - case studies for application

KFK-PDV 11

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 11, October 1973
263 pages

Volume 1 (KFK-PDV 10) describes a machine and problem independent "Multi Level Dialog Language" and its implementation, the "Multi Level Dialog System". The system offers a choice of different language-levels, so that users with varying system knowledge have access to the same computer functions. The defined language may be modified and extended at any time, even during operation, for which no additional programming is required. The user has complete freedom in defining the computer action associated with a given input (i.e. with the semantics of this input). Furthermore the volume discusses the adaptation to a system (installation) and the adaptation to a selected problem (application) as well as possible subsets of the MULI-language and the MULI-system. This includes the definition of those parameters which are required to tailor a system to the special needs of a user.

Volume 2 (KFK-PDV 11) contains six studies. For each of these studies a computer system is selected and the required specifications are given.

(DM 15,--)

E. Kazis:
Interactive Dialog System Part II

KFK-PDV 12

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 12, October 1973
45 pages, 10 diagrams, 6 figs., 8 refs.

The study deals with the implementation possibilities of the interactive dialog system IDIAL. This is handled in three steps.

Step 1:

Off-line definition phase:

Generates a dialog system that handles special case applications

Step 2:

Syntax testing:

To insure that the syntax of the given instructions matches that of the dialog system

Step 3:

Module construction:

Contents and task of each module is written.

The new problem oriented language PEARL will be used to program these three steps.

(DM 5,--)

W. Kutzsche, U. Voges:
GAUSS - a System for Structured Programming

KFK-PDV 13

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 13, October 1973
105 pages, 18 figs., 23 refs.

The design language GAUSS is used for the analysis of complex problems, for the generation of portable and adaptable programs and for their complete documentation. A problem is analyzed, solved, and documented graphically by stepwise refinement. The first step is done by modelling the problem into a graph, in which actions and data are explicitly represented as nodes. Each element, action or datum, is then refined into a structured net of actions and data again. Thus step by step a hierarchical solution of the problem is developed in the form of a set of graphical modules. The GAUSS macro processor generates the program out of these modules. Both, the design language and the macro processor GAUSS, form the central constituents of a language-independent programming system.

(DM 10,--)

H. Unbehauen, B. Bauer, B. Göhring, Chr. Schmid:

KFK-PDV 14

"On line"-Identification Methods
Evaluation of Literature and Review of the Methods

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 14, August 1973
79 pages, 18 figs., 4 tab., 142 refs.

The basic reports regarding the on-line parameter estimation methods have been selected from a variety of papers, and collected in this report. In consideration of common structures, the different methods were demonstrated in a concise form and compared critically, as far as possible, with regard to their efficiency and practical application. (DM 10,--)

W. Bamberger

KFK-PDV 15

Static Optimization of Technical Processes

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Bericht KFK-PDV 15, August 1973
58 Seiten, 12 Abb.

The motivation for this survey was to give an introduction in the techniques for the solution of optimization problems in a static behaviour besides a survey of the quite voluminous literature which is not at all complete.

The survey is based on a systematic division of experimental optimization strategies. In detail some terms and methodics are explained by means of some process examples, modifications to these processes are stated and their essential advantages or disadvantages are briefly described.

However, the survey does not enter into concrete applications but describes in general the possibilities of an experimental static optimization.

The literature mentioned lays no claim to be complete and is stated till March 1973 as far as known.

(DM 10,--)

D. Hilse:

KFK-PDV 16

Interrupt Primitives for Process Control Systems

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 16, November 1973
22 pages, 19 figs.

This report describes on the basis of priority interrupt systems the definition of standardizable interrupt primitives for process control systems, and the management of interrupt cascades with these tools. (DM 5,--)

Rudi F.W. Grimm
Comparison of Redundancy Reduction Algorithms with respect to System Protection Using Process Controllers

KFK-PDV 17

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 17, February 1974
33 pages, 57 figs., 7 tab.

The advancing automation of technical systems requires an adequate automatic system-protection - including the system-control as one part - by using a process-controller. System-data collection is one main problem of the system-protection. The data have to be free of redundancy (as much as possible) because of the limited storage-capacity of the process-controller. With regard to the given requirements ten redundancy reduction algorithms have been tested with six signals and have been compared with respect to the main criteria "compression", "errors", and "computer load". Four predictor- and interpolator-algorithms show to fit best to the criteria. (DM 10,--)

O. Eggenberger:
Hardware extended executive primitives for process control systems - Synchronisation primitives (4. intermediate report)

KFK-PDV 18

Gesellschaft für Kernforschung m.b.H., Karlsruhe
Report KFK-PDV 18, January 1974
27 pages, 7 figs., 4 refs.

This paper describes executive primitives for the access synchronisation to shared data and for the synchronisation caused by events used to coordinate parallel processes.

(DM 5,--)

K. Etschberger, R. Zimmermann:
Human Operator Characteristics and Capabilities in Performing Process Control Tasks

KFK-PDV 19

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 19, January 1974
24 pages, 6 fig., 20 ref.

With the increasing use of computer for process control and monitoring, human operator tasks become increasingly more complex especially when responding unforeseen events. Therefore also in highly automated processes, human operator information processing capabilities are of prime importance.

It is the purpose of this paper to analyse human operator characteristics in performing these tasks in order to achieve a better integration of man and process. (DM 5,--)

K. Etschberger, R. Zimmermann
Visual Display Systems for Use in Process Control Consoles

KFK-PDV 20

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 20, January 1974
43 pages, 12 fig., 3 tabs., 101 refs.

Visual display systems are the most important information output devices for use in modern process control consoles.

This paper gives a survey of the different kinds of display systems with reference to numerous reports. Because of their importance especially CRT displays presently available on the market are covered and described. (DM 5,--)

Hans D. Hoelzer, H. Röck, J. Waidelich:
Methods of detecting and locating faults of combinatorial
and sequential circuits

KFK-PDV 21

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 21, March 1974
56 pages, 275 refs.

Following a brief consideration of the advantages of automatic
fault diagnosis in digital systems, this report discusses the
methods of detecting and locating faults on the gate-level, with
particular emphasis on combinatorial and sequential circuits.
This report is based on a number of references given in the
appendix. (DM 10,--)

R. Moog:
Recognition of symbols on visual displays (Recommendations for
equipment designers)

KFK-PDV 22

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 22, March 1974
21 pages, 26 figs.

This report deals with data concerning human factor's information
related to the design of visual displays especially CRT's. The subjects
covered include legibility of alphanumeric and other elementary
symbols. (DM 10,--)

W. Becker, et.al.:

KFK-PDV 23

Applications for programmable external modules in computerized
process control systems

Gesellschaft für Kernforschung mbH., Karlsruhe
PDV-report KFK-PDV 23, March 1974

The Efficiency of computer oriented process control systems can be
increased by programmable digital and analogue modules which take over
special tasks from the central processor unit. They make possible the
introduction of decentralized structures.
Nine different applications are described and discussed in view of

- economy
- accuracy
- speed
- modularity and
- reliability

(DM 10,--)

Rolf Zimmermann:
Analysis of Requirements for Visual Displays and Associated Controls

KFK-PDV 24

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 24, April 1974
15 pages

This publication contains a questionnaire which can be used both for
specification of user Requirements concerning display and control
capabilities and for analysis of characteristics of existing equipment.
The questionnaire is preceded by a short introduction.

(DM 5,--)

J.F.H. Winkler

A view of the costs of the realization of data structures

KFK-PDV 25

Gesellschaft für Kernforschung mbH, Karlsruhe

PDV-report KFK-PDV 25, June 1974

43 pages, 15 figs., 28 refs.

In generating operating systems adaptively the optimal version for a special application is to be selected out of a set of versions of operating systems. One feature in which these versions differ is the realization of the necessary data structures. In order to be able to compare the different realizations of data structures, the costs which arise by using the data structures are considered. These are the costs of the memory for the data and the memory for the routines to manipulate the data and the costs of the time required to execute these routines. The present part 1 deals with the realization of elementary data, records, and arrays.

(DM 5,--)

H. Unbehauen, F. Böttiger

Control algorithms for implementation on process control computers

KFK-PDV 26

Gesellschaft für Kernforschung m.b.H., Karlsruhe

PDV-report KFK-PDV 26, September 1974

108 pages, 27 fig., 1 tab., 68 refs.

The present paper tries to give a survey about the control schemes for one-dimensional controlled systems which are especially suitable for the use with direct digital control. First of all, continuous controllers are designed, concentrating on the PID-algorithm in its different forms and modifications. Furthermore, algorithms designed on the basis of the compensation of the controlled system in discrete representation, are considered. The best known algorithm of this class is the deadbeat response algorithm, which can be designed in the frequency range as well as in the time range. Further classes of algorithms are those with preset structure, which are optimized according to a criterion, special controllers for stochastically disturbed systems as well as nonlinear algorithms.

The mentioned literature represents only a selection of the existing contributions to this theme.

(DM 10,--)

U. Bäck

Problems of communication and data acquisition in computer-controlled production systems

KFK-PDV 27

Gesellschaft für Kernforschung m.b.H., Karlsruhe

PDV-report KFK-PDV 27, October 1974

43 pages, 21 figs., 21 refs.

Acquisition of operating data, particularly in computer-controlled equipment, forms the basis for improvement and monitoring of the production sequence as well as the basis for control and optimization of the production process. This report deals with the problems of on-line data acquisition and with communication between man and acquisition system. An acquisition plan will be presented in which the minicomputer, connected to one of the production computers, will be employed as a central data acquisition point as well as for data concentration.

(DM 10,--)

KFK-PDV 28

E. Verhaag
Machine Tool Control, Computer Linked Numerical Control

Gesellschaft für Kernforschung m.b.H., Karlsruhe
PDV-report KFK-PDV 28, October 1974
82 pages, 38 figs., 6 tab., 20 refs.

An economically attractive control unit has been developed for NC machines in production technology. By shifting the functions of conventional NC to the production computer, an NC system of reduced scope is produced: machine tool control.

The modular layout described here permits adaptability to very varied tasks, both in the field of production technology and in other branches of industry. The flexibility of the system is shown by its facility for monitoring production, by involving AC systems as well as automatic cutting distribution. The testing and diagnostic aids provided by the system contribute to increased utilization of the whole installation, so that better economy can also be expected.

(DM 10,--)

M. Gutmann:
Requirements for Control station design

KFK-PDV 29

Gesellschaft für Kernforschung m.b.H., Karlsruhe
PDV-report KFK-PDV 29, October 1974

After an approximate classification of various processes according to levels of automation "low - average - high" the layout of the manual stations on a central desk and on a secondary panel is described as a possibility of designing modern control stations for a plant with a high level automation. The requirements to be met by control systems in respect of computers are derived from a comparison between two conventional control stations and two computerized control stations. These four control stations are compared with emphasis of the aspect of disturbance.

(DM 5,--)

F. Freyberger, G. Landvoigt, G. Schröder, H.-R. Tränkler

KFK-PDV 30

Gesellschaft für Kernforschung m.b.H., Karlsruhe
Report KFK-PDV 30, December 1974
88 pages, 25 figs., 128 refs.

During process control with data processing systems the analog process variables have to be adapted to the digital computer. Conventional instrumentation systems and their components are characterized by the subsequent adaption of the process control computer. The presented papers show the main difficulties with the application of traditional instrumentation systems and alternatively show the essential characteristics of an instrumentation system with frequency-analog signal representation.

These conspicuous characteristics are

1. signal structure allows simple inexpensive digital conversion,
2. excellent transfer characteristics give high noise immunity,
3. high system accuracy for charging purposes (weighing technique),
4. high reliability by parallel signal channels up to the digital bus-line.

(DM 10,--)

F. Hock, G. Schaffrath:

Linear cost minimisation with process computer

KFK-PDV 31

Gesellschaft für Kernforschung m.b.H., Karlsruhe
Report KFK-PDV 31, January 1975
58 pages, 4 figs., 7 tabs., 2 refs.

The objective of the project was the cost minimisation of processes. By means of this system the plant engineer has the possibility of steering the processing-parameters to optimize the costs in course of operation. Methods of linear programming have been adapted to the requirements of process computers and process control. This report gives a review of applications of and experiences with a software package for linear programming.

(DM 10,--)

F. Karow, G. Rubow, L. Voß, J. Weber

Project of a studio for automatic textile patterning

KFK-PDV 32

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 32, January 1975
158 pages, 58 figs., 3 tabs., 13 refs.

The description of the studio for automatic textile patterning drafted herewith consists of three volumes.

Volume 1 shows the fundamentals of the studio for automatic textile patterning and the reasons for setting up such a studio. On this basis, the concept of a studio for automatic textile patterning is examined with regard to its usability considering especially economic aspects. The result is the suggestion to start with the first level of realisation: Automatic patterning for carpet Jacquard weaving.

Volume 2 deals with the development of the studio for automatic textile patterning. The first part gives a description of devices, the second part the description of software concerning the patterning.

Volume 3 finally presents the job scheduling in the studio and the dialog between operator and computer.

(DM 13,--)

G. Färber

Redundant Serial-Loop-System with standardized Interfaces

KFK-PDV 33

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 33
68 pages, 6 figs.

The conception, development and construction of a digital transmission system suitable for the connection of decentralized process peripherals is described. The System has the following characteristics:

- Serial transmission system for the connection of a maximum of 255 substations each having 255 subaddresses/functions.
- High system reliability through a double system with automatic switching of the connection elements; coding procedure allows connection of substations without breaking of connections.
- High data reliability through CRC-protection-byte and corresponding transmission processes (message acknowledgement with message counter).
- Message length $(N + 5)$ bytes, where N gives the number of data bytes. Transmission rate maximum 5 Mbit/sec (realized: 500 Kbit/sec).
- Alarm transmission according to geographic priority; additional common alarm bit in the header, which shows the central processor that there are requests outstanding; overriding of geographic priority by global reading.
- Hardware requirement for decoding, parallel/serial conversion, automatic switching, CRC generation/checking, hardware procedure control: 1 10 x 16 cm card.
- Suitability for adaption to standard interfaces (for example, V 24, CAMAC).

(DM 10,--)

W.G. Schneeweiß:

Derivation of reliability-parameters of process-control systems

Gesellschaft für Kernforschung m.b.H., Karlsruhe

Report KFK-PDV 34, February 1975

70 pages, 13 refs.

KFK-PDV 34

The main results which are explained in detail in this report are the following:

- a) An algorithm for an approximate calculation of availability and MTBF of redundant repairable systems from relevant data of subsystems. To this end a computer program can be used.
- b) Easy-to-survey formulas for the calculation of availability and MTBF of a system with preventive maintenance - where inspection and replacement are supposed to be performed very quickly - from the distributions of uptime and downtime resp. time between inspections.
- c) A method for the evaluation of the probability for the operability of a plant during a mission with given pauses and explicit for the case of exponential distributions of the periods of usefulness (uptime) and of disturbances.
- d) Diverse simple formulas for calculating the MTBF of redundant repairable systems with statistical dependencies between the states intact and/or defective of subsystems and a proof of the fact that statistical dependencies can result from certain repair strategies.

All these results are important building-blocks of the as yet incomplete reliability theory of process-control-systems using electronic-computers.

(DM 10,--)

U. Baumann, U. Trilling

Fast formation of test results in the case of slow, stochastically disturbed measuring systems

Gesellschaft für Kernforschung mbH, Karlsruhe

PDV-report KFK-PDV 35

164 pages, 68 figs., 9 tabs., 29 refs.

KFK-PDV 35

Measurement results are early determined by means of computer for process control. Algorithms of linear estimation theory and knowledge of the system dynamic (linear mathematical model) are assumptions of this prediction.

Results are tested at a pilot weighting machine to reduce weighting time and at a contact thermometer to accelerate temperature measurement.

Statements are given upon assumptions, precision to be achieved and general expenditure.

(DM 13,--)

H.G. Jacob

FORTTRAN-Program for the Evaluation of a Local Optimum of a Bounded Multivariable Function without Determination of its Derivates

Gesellschaft für Kernforschung mbH, Karlsruhe

Report KFK-PDV 36, April 1975

38 pages, 11 figs., 18 refs.

KFK-PDV 36

The FOTRAN-algorithm presented in this report, for the determination of a local optimum of a multivariable function, shows the following combination of characteristics: simple application, small size of the program (ca. 100 FORTTRAN-statements), little requirements in storage (application of process computers), evaluation of the function derivatives not necessary (even extrema of discontinuous functions are determinable), possibility to consider a variety of boundaries (the initial values of the input variables however have to be located in a permitted area), low number of search steps (i.e. function evaluations) for the determination of the extremum with a given precision (convergence however is not provable for any imaginable function).

(DM 5,--)

H. Unbehauen, Chr. Schmid, F. Böttiger, B. Bauer, B. Göhring:
KEDDC: A combined process computer program system for the design
and application of DDC algorithms.

KFK-PDV 37

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 37, April 1975
85 pages, 22 figs., 56 refs.

The new program system KEDDC described in this paper represents a combined process computer program system for the design and application of DDC algorithms. This program system allows the on-line identification of industrial plants, and, based on that, the interactive design of optimal controllers and finally the corresponding process control in DDC-operation. The complex program system is built up in modular form. It consists of moduls for system identification and design methods as well as higher DDC algorithms. By its comprehensive applicability and by the possibility for on-line modification, the system shows a high degree of flexibility. The program system can be easily implemented on other process computers because of its extreme independence from the computer and the corresponding executive system using FORTRAN IV. The portability of the system permits the implementation of the program moduls in already existing or new developed program systems for special applications.

(DM 10,--)

R. Zimmermann:
Design of Man-Machine-Communication-Systems
Basic Human Factors, Demands and Recommendations

KFK-PDV 38

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 38, April 1975
31 pages, 2 figs., 5 tab., 32 refs.

This paper shows some fundamentals of man-machine-communication and deduces demands and recommendations for the design of communication systems.

The main points are the directives for the design of optic display systems with details for visual perception and resolution, luminance and contrast, as well as discernibility and coding of displayed information. The most important rules ar recommendations for acoustic information systems, control devices and for design of consoles are also given.

(DM 5,--)

G. Friesland, H. Ovenhausen:
Testing of Real-Time-Software - Analysis of User Interviews and
Relevant Literature

KFK-PDV 39

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 39, May 1975
46 pages, 9 figs., 142 refs.

The situation in the area of testing real-time-software is unsatisfactory. During the first phase of the project PROMOTE (prozeßorientiertes Modul- und Gesamttestsystme) an analysis of the momentary situation took place, results of which are summarized in the following study about some user interviews and an analysis of relevant literature.

22 users (industry, software-houses, hardware-manufacturers, and institutes) have been interviewed. Discussions were held about reliability of real-time software with special interest to error avoidance, testing, and debugging.

Main aims of the analysis of the literature were elaboration of standard terms, comparison of existing test methods and -systems, and the definition of boundaries to related areas.

During the further steps of this project some means and techniques will be worked out to systematically test real-time software.

(DM 10,--)

J. Ehrig, H. Hahn, H. Hotes, A. Ibarra, E. Skrebutis:
COFF - A Set of Program Building Blocks for Real-Time Operating Systems

KFK-PDV 40

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 40, May 1975
100 pages, 30 figs., 26 refs.

Depending on the application, operating systems for process control computers must often be changed, extended or newly developed. To simplify these tasks a set of functional building blocks for constructing real-time operating systems was designed. The programs are organized in layers. The lowest layer consists of hardware-dependent basic functions, the middle layer of functions that are neither hardware nor application dependent, and the upper layer of application-specific functions. For the transfer of an operating system to another computer or the design of a system for a new application area only part of the building blocks must be reprogrammed.

(DM 10,--)

Development of Sensors for Process Control Systems in the Field of Production Engineering

KFK-PDV 41

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 41, May 1975
80 pages, 35 figs., 28 refs.

Several Institutes of the Hochschulgruppe Fertigungstechnik (HGF) develop process control systems for metal cutting as a common project. An account is given of the development of sensors for measuring characteristic values of the production processes turning, milling, drilling, and grinding. In detail sensors for tool wear, for the approach of tool to work, for the components of cutting force, and for the surface roughness are represented. The performance of each sensor is specified.

(DM 10,--)

R. Hoefert, J. Lemmrich:

KFK-PDV 42

Compilation, classification, and evaluation of components for frequency analog process instrumentation systems

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 42, September 1975
61 pages

The components for a frequency analog instrumentation system have been developed under the PDV project. It is examined in this report how many of such components are presently available and can be realized respectively. The literature and advertising material were sifted thoroughly. The components are classified and clearly shown in tables and diagrams. The results are evaluated and discussed. A comprehensive list of references is annexed.

(DM 10,--)

J. Kröger:

Early Recognition of Defects in the Machinery of Ships.

KFK-PDV 43

Gesellschaft für Kernforschung mbH, Karlsruhe

PDV-report KFK-PDV 43, June 1975

97 pages, 26 figs., 8 tabs., 3 refs.

Service interruptions in the machinery of large and fast ships have an important influence on the safe and economical operation of these ships. Conventional alarming equipment monitors defects mostly when they are critical. An early recognition of defects would avoid interruptions and make it possible to plan the repair with respect to the schedule of the ship.

It is reported about a collection of defects, which was necessary to select areas in the machinery, whose defects have a significant influence on the ships service and for which an early recognition is feasible. For three important areas (fuel injection system, exhaust valve, starting air valve at a diesel engine) this new supervision, the design of the necessary new measuring devices and the linkage of these devices to a computer is described.

(DM 10,--)

H.J. Günther, W. Werum, H. Windauer:

Problem Oriented Language for Transport Systems, Language-Report

KFK-PDV 44

Gesellschaft für Kernforschung mbH, Karlsruhe

PDV-Report KFK-PDV 44, May 1975

212 pages, 5 figs.

A computer independent extensible language is described, which allows the user himself to program discrete event-driven processes with problem-oriented formulations. The development of the language took into account the safety and self-control of the user programs. The computer-oriented statements (for example alternatives, loops, I/O) are the same as in PEARL.

(DM 16,--)

O. Hasenfuß. R. Zimmermann:

Selection of Input Devices and Controls for Modern Process Control Consoles

KFK-PDV 45

Gesellschaft für Kernforschung mbH, Karlsruhe

Report KFK-PDV 45, June 1975

In modern process control consoles man-machine communication is realized more and more by computer driven CRT displays, the most efficient communication system today.

This paper describes the most important input devices and controls for such control consoles.

A certain number of facts are given, which should be considered during the selection.

The aptitude of the described devices for special tasks is discussed and recommendations are given for carrying out a selection.

(DM 5,--)

G. Köhler, H. May:

Methods and Means Contributing to the Guide Lines for Central Control Stations

KFK-PDV 46

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 46, June 1975
48 pages, 29 figs., 3 tab., 13 refs.

All instrumentation for plant process control is centralized in control stations. The design of the control stations where the operator supervises the automations, depends on the application and the local conditions of the process.

The authors present a survey on the physical design of control stations. This report refers to ergonomical principles and gives a short glimpse on control technology, the present equipment and display devices.

The possibilities of process analysis with existing control station concepts and the use of planning aids for the layout are described in detail. Hereafter follows an explicit representation of the possibilities of realization showing the trend of development by an example. The following explanations are the contribution to the guide lines of control stations.

(DM 10,--)

KFK-PDV 47

W. Patzelt, M. Salaba:

A method for performance comparison of DDC-algorithms and application of this method to selected cases by means of the computer program OPTAL

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 47, July 1975
65 pages, 2 figs., 10 tabs.

Characteristics and test setups are defined for the comparison of direct digital control algorithms for single variable control.

Under the test setup

- process
- process controller
- signal

the control algorithms to be compared are characterized by the characteristics

- quality measure
- sensitivity measure
- costs.

The defined characteristics under the defined test setups are investigated for four types of algorithms designed with respect to

- deadbeat response
- minimal integrated squared error
- quantity optimum (PID-structure)
- quantity optimum with compensation of dead time by the process model (PID-structure).

A digital computer program "OPTAL" for design and simulation of direct digital control is used.

(DM 10,--)

KFK-PDV 48

G. Schaffrath, M. Shahata

"Adaptive Process Control with Trend Model"

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 48, August 1975
128 pages, 28 figs., 64 refs.

The intention of this work was the development of a universal model for adaptive control. The proposed trendmodel is a statistical description of rapidly varying processes which are otherwise difficult to describe. The model uses only signals from a plant in usual action because test signals are often prohibited by costs and safety regulations. The algorithms are formulated in a general way to be used as well for the identification of a system as for its control. The conditions of real time action and the capabilities of process-computers are allowing only for algorithms with restricted running time and core requirements. The described trend-algorithms worked well under the conditions of several real applications.

(DM 10,--)

J. Nehmer, O. Eggenberger:
Hardware Extended Executive Primitives for Process Control
Systems

KFK-PDV 49

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 49, June 1975
96 pages, 15 figs., 26 refs.

The report summarizes the results of a PDV-project of the same name. It is divided into three parts, describing a structuring concept for real time operating systems, a set of elementary operating system functions defined within the frame of the structure and a related real time software production system.

(DM 10,--)

Report on the PDV-Workshop in Munich on December 1974

KFK-PDV 50

"MIKROPROZESSOREN UND MEHRPROZESSORSYSTEME FÜR DIE
PROZESSENKUNG"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Bericht KFK-PDV 50, August 1975
122 pages, 41 fig., 6 tables, 43 ref.

The following report contains essentials of single papers presented at the PDV-Workshop on "Microprocessors and Multiprocessor Networks" held on December 5 and 6, 1974 in Munich.

The most important features of microprocessors and micro-computer components - available today - are listed up and described briefly. Besides typical application schemes are presented.

(DM 10,--)

R. Didic:
DC 161 data controller for process automation application

KFK-PDV 51

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 51, July 1975
45 pages, 6 figs.,

The DC 161 data controller is a programmable unit for process automation applications. It may be used as a central element to control plant equipment, control centres, communication systems, data concentrators etc. Modular design permits assembly of cost-effective dedicated system configurations.

Eight program levels, with eight hardware registers each, are provided. Direct program level switching is achieved by simply applying a switching request signal - thus providing for a fast reaction to external events.

A particular control interface allows internal central processor sequences to be controlled by external functional units.

(DM 5,--)

P. Kreis, H. Heikel:
ACCS Adaptable Computer Simulation System
Gesellschaft für Kernforschung mbH, Karlsruhe
EDV-report KFK-PDV 52, July 1975
76 pages, 3 figs., 4 tabs.,

KFK-PDV 52

The study describes a simulation system whose principal area of application is process computer control and related fields.

The major functional components treated are: Generator, simulator, and machine-description language. The first level of the machine-description language is described in special detail.

The guiding idea in the system concept is to let the generator receive the particular characteristics of each machine to be simulated from the machine description, and construct an optimal simulator especially tailored to that machine.

This method also provides an ideal solution environment for optimization problems which arise in technical and scientific work.

This bibliography is intended to be a subjective selection which should allow descriptions and comparisons. An attempt is made to demonstrate some of the problems of simulation by means of a concrete example. (DM 10,--)

F. Wagner, H. Woda:
"PROCESS BASIC"

KFK-PDV 53

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 53, August 1975
160 pages, 3 refs.

PROCESS BASIC is a programming system for process control and scientific applications by means of a mini-computer. The PROCESS BASIC-language consists of the high-level programming language BASIC, a powerful macro-assembly-language, and the machine code of the used computer. These three language levels can be mixed line by line. Formated input/output statements, and statements for interrupt handling and real-time programming are available. Any processperipherals can be connected to the system easily via a simple software interface. The complete system consists of a one-pass-translator, a loader, a linkage-editor, and a newly developed operating system using 8k (20 bits) of working storage. PROCESS BASIC has been implemented on an UNICOMP 201 computer.

(DM 13,--)

R. Isermann, D. Bux, P. Blessing, P. Kneppo

KFK-PDV 54

"Control Algorithms for direct digital Control with Process-Computers"

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 54, August 1975
134 pages 30 figs., 11 tab., 49 refs.

Methods for the design of parameter optimized, deadbeat and state variable control algorithms are described, which are especially suited for the computer aided design. It is assumed, that a process model in parametric and time-discrete form has been obtained by process identification. Results of simulations give hints for the design, especially for the selection of sampling time and the weighting factor of the process input. Eight selected control algorithms are compared with regard to the resulting control performance, the sensitivity for unexact process models, the computing time between samples, the computing time and the storage for the synthesis with process computers. Finally methods for the design of feed forward control algorithms are described.

(DM 12,--)

P.J. Brunner, H. Bösmann, A. Tarabout, W. Werum

KF K-PDV 55

The universal PEARL-operating-system

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 55, January 1976
292 pages, 3 figs.

Based on the semantics of the real-time language PEARL the complex relationship between individual functions was examined and a program package was produced containing all the operating system functions necessary for PEARL.

The program package is written in PL/1 and is available as a basis implementing PEARL, especially on medium scale computers. The interfaces both to the compiler and to hardware dependent functions, which cannot be part of a universal operating system, are well defined. The program package is modularized such that PEARL subsets can also be served.

The following paper provides a description of this package.

(DM 18,--)

SCS Scientific Control Systems GmbH, Hamburg

KFK-PDV 56

MULI - MULTI LEVEL DIALOG LANGUAGE - Language and System Description

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Bericht KFK-PDV 56, September 1975, 160 pages, 2 figs.

The structure of a command is defined by the MULI-language as a command verb and a sequence of specifications. In the MULI-system there are elementary commands directly associated to function modules of the application system controlled in dialog, and a variable number of user-defined and application-oriented compounds made up of elementary commands by means of a very general and flexible macro-technique. Furthermore nomenclature of commands and delimiters may be freely defined by the users themselves so that they have available language means adapted to their special needs. The command repertoire may be modified or extended at any time, even on line. The MULI-system (coded in POLYP) is adaptable to core and performance restrictions by an automatic generation process, having standardized interfaces to application function modules and the operating system it is readily portable with regard to different applications and various hardware systems currently on the market.

(DM 13,--)

E. Holler, O. Drobnik, R. Knöpker:

KFK-PDV 57

Design and modeling of distributed computer systems for process control applications

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 57, September 1975
99 pages

Criteria for process control applications of distributed computer systems are compiled and basic control concepts of these systems are developed. Control and structure of distributed computer systems can be fitted to given realtime requirements by applying a modeling system which is described in detail. Modeling experiments are discussed and results obtained shown.

(DM 10,--)

E. Heller, R. Knöpker, O. Drobnik:

KFK-PDV 58

A Simulation program for the Modelling of Control Structures for Computer Networks

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 58, September 1975
67 pages

Computer Networks are an area of advanced technology. For their design and analysis the engineer should benefit from powerful design-tools. This report describes a simulation program based on SIMULA, which we claim to be a powerful instrument for the modelling of control structures for distributed computer systems.

(DM 10,--)

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F. ...

KFK-PDV 59

A microprogrammed process unit

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 59, October 1975
71 pages 4 figs., 3 tabs., 2 encl.

In this report progress and results of a subsystem development in the process data transmission field are described. This development was induced by the recent progresses in semiconductor technology, especially with semiconductor storage elements. The resulting subsystem, designed for converting, handling, multiplexing and transmitting process data is controlled by a microprogrammed unit of general structure. This concept considerably enlarges the capabilities of the subsystem. Besides the subsystem itself some resources developed for its usage and some applications are described.

(DM 10,--)

R. GÜth

KFK-PDV 60

"Microprogrammable Interface"

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 60, November 1975
34 pages, 35 figs.

The variety of different interfaces in peripheral equipment is a special problem in planning data processing systems. Different word length and special conventions of different manufacturers make it impossible to define a general standardized interface. Therefore it is reasonable to design a flexible interface, which can be realized very economically by microprogramming. This report describes the concept and implementation of a microprogrammable interface.

(DM 5,--)

R. Moog:

KFK-PDV 61

Coding of visual information

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-repoert KFK-PDV 61, December
68 pages 31 figs., 4 tabs.

This report deals with human factors data related to coding problems of visual displays. The subjects covered include informations about applicability of information theory to human information processing, human channel capacity, comparisons between coding dimensions, deals with further parameters affecting effectiveness of coding, characteristics of coding dimensions.

(DM 10,--)

P.J. Brunner, W. Hinderer, W. Werum

Optimisation methods in systemprogramming

KFK-PDV 62

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 62, January 1976
250 pages, 3 figs., 11 refs.

An optimiser program is introduced, which optimises programs represented in an intermediate language (IL 1) which is independent of source language and computer structure. The optimisation techniques are chosen with the particular objective of reducing the execution time of system programs written in high level languages by the

elimination of redundant operations,
removal of invariant operations from loops and strength reduction
including linear address incrementation for array elements.

The optimiser program incorporates a global analysis of the possible value of program topology identifying all program paths and loops.

(DM 17,--)

P. Adamczyk, D. Gerlach:

KFK-PDV 63

Possibilities and Limitations of the Use of Process
Computers in Manufacture

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 63, December 1975
218 pages, 38 figs., 30 struc.fig., 141 refs.

This study reviews the possibilities and limitations of the use of process computers in manufacture, analyzing the information flow in manufacture and explaining the software required for the automation.

Based on 35 European, 40 Japanese, and 42 American manufacturing systems the present technical state is represented with regard to the use of process computers in manufacture, particular emphasis of the evaluation being laid on the realized functions of the information flow and on economic aspects.

(DM 16,--)

W. Hinderer, W. Werum

KFK-PDV 64

Methods for testing and generating real-time operating systems

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 64, January 1976
272 pages, 1 fig., 40 refs.

In programming real-time operating systems complex structures are generally involved which complicate testing considerably.

In this paper methods are illustrated for the automatic computer-supported testing of operating systems. Particular attention is given to the automatic analysis of programs and to the dead-lock problem. Furthermore, a very high level language for real-time operating systems is proposed allowing automatic generation of program and data structures.

(DM 18,--)

U. Baur

KFK-PDV 65

"On-line-parameter estimation methods for the identification of linearizable dynamic processes with process computers - development, comparison, proving -"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 65, January 1976
135 pages, 79 figs., 19 tabs., 52 references

Various recursive parameter estimation methods for the identification of linearizable dynamic processes are compared first by digital simulation. Best suited for the on-line identification with process computers are the methods of "instrumental variables" and of "correlation analyses with parameter estimation". Both methods are improved and modified for the application in process computers. Methods for search of model order and time delay and methods for the elimination of low frequent disturbances (drift) are investigated.

For the practical test of the different methods a FORTRAN program package called OLID has been developed for the on-line identification with process computers. Experiments with a steam heated exchanger show the performance of the identification methods for the case of very small signals.

(DM 10,--)

A. Weimann, K. Wanka

KFK-PDV 66

"Computer program GANESI - Description of a computer program for the simulation of unsteady flows in gas distribution networks"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 66, January 1976
28 pages, 3 figs., 1 table, 11 references

Models for the simulation of the dynamics of gas distribution networks play an important role for design and control of these processes.

In this report the computer program GANESI for the simulation of unsteady flows in gas distribution networks is described.

Network modelling, applications and handling of the program are discussed. The validity and efficiency of the program are demonstrated by calculated network examples.

(DM 5,--)

A. Giese, H. Ovenhausen, P. Ruts:

KFK-PDV 67

"PROMOTE, Module and Integration Test System for Realtime Software"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 67, February 1976
62 pages, 11 figs., 2 tabs.

For testing realtime-software PROMOTE suggests running a module and integration test on a host computer and a system test on the target computer.

The module test system allows systematic testing of a software system. A set of macros can be used to build an individual module test environment. The integration test system performs an interface trace during the modul integration test.

Some realtime test and debugging aids are designed for the system test on the target computer.

(DM 10,--)

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U. Bäck, A. Schüring

DNC-System

KFK-PDV 68

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 68, January 1976
122 pages, 79 figs., 40 refs.

The first research activities performed at the Laboratorium für Werkzeugmaschinen und Betriebslehre in the field of machine tools control by process computers included the development of methods, programs and process units, and the public presentation of a pilot system at the 14th Aachen Colloquium on Machine Tools in 1971. The positive results obtained led to a continuation of work under a new project which is described in this report. The results described within this report are concerned with: DNC-system analysis, methods for computer control system performance evaluation, operating data acquisition with the corresponding software, real-time process simulation and production control system.

(DM 13,--)

K.-H. Arnheim, A. Bellmer, O. Böhlinger, E. Chazelas,
H. Kregeloh, H. Lengler, A. Mies, A. Ottke:

KFK-PDV 69

"Information and communication system for automatic bus monitoring and supervising"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 69, May 1976
120 pages, 39 fig.

A "closed-loop" information and communication system was developed in the Automatic Bus Monitoring in order to link the control centre with the running busses. The information flow is controlled by a computer.

Via radio data channel a polling routine defined by the schedule sequentially interrogates each bus for its present location, which is transmitted to the computer together with the automatically provided count data of boarding and alighting passengers.

The central processor carries out data handling, in a clear way provides the dispatcher with schedule deviations on a CRT colour display unit, and stores selected data for later statistic analysis.

(DM 10,--)

E. Buxmeyer, G. Haussmann, P. Mielentz, H. Walze

KFK-PDV 70

Serial Line Sharing System for Industrial Real-Time Applications (PDV-Bus)

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 70, May 1976
51 pages, 14 figs., 7 tabs.

Within the PDV Workshop TP 30 experts from industrial companies and research institutes designed a process data transmission system suitable for all industrial applications where large distances have to be covered, realtime conditions have to be met and high reliability is more important than high transmission speed. The Workshop proposes a bitserial linesharing system with alarm capabilities and provisions for passive coupling of geographically distributed stations. Appropriate implementations in PDV-projects shall serve as solid basis for an improved proposal for standardization.

(DM 5,--)

D. Herbst, J. Kremser

KFK-PDV 71

A Study on the Applicability of the Problemoriented Language PSF
to Plant Transportation Systems

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 71, May 1976
91 pages, 35 figures, 24 references

The starting-point of this study was the preparation of the use of the "Problemspezifische Sprache für Förderprozesse (PSF)" (Problem-specific Language for Transportation Processes) in the region of interdepartmental means of transportation. This required the analysis of means of transportation in the aspect of future computer control.

Due to the variety of types of means of transportation a model construction was necessary to cover entire classes of construction. The general validity was attained by use of the elementary qualities as characteristics (e.g. to adhere to the sequence of goods, to single) of the model elements.

The more detailed description of means of transportation constructions was dropped and so-called transport elements with fundamental functions were introduced. As model elements they offer good possibilities of reproduction of the means of transportation.

The analysis described the structures of the transport elements (transport segments and switches) from the view of both static construction and dynamics of operations.

A separate chapter is dedicated to the drive and its structure elements. Its description is also made in the view of the transferability into the PSF-core (DIPOL). The advantages of structured programming can be utilized by dividing the transport network into subsystems - transport zones and transport regions. Elements have been defined which clearly fix the limits of the subsystems.

The interfaces towards the environment are covered by materialflow sources (feeding points) and negative sources (targets). It was determined which model elements can carry out these functions.

The geometry of a transportation system can be described by structured distance data or coordinates. These model elements have been summarized in one chapter.

The defined terms of mechanical handling form the basis for a formal, problemoriented language as endeavours were made to derive the definitions from the primary terms such as marked point, goods data, vehicle, conveying track, direction and drive. This leads to structured model elements which can be transformed into the formal language by means of the structure attributes existing in DIPOL. This result of the study was testified in the appendix by a practical example which demonstrates the process of transformation.

An important side effect of this study is the contribution to the determination of mechanical handling terms which so far rarely had an unambiguously defined meaning.

(DM 10,--)

T. Derenbach, R. Kleesang, E. Verhaag:

KFK-PDV 72

"Contouring Control System, Design and Development of an optimal lay out, partially computer-integrated Contouring Control System for Machine Tools"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 72, February 1976
84 pages, 50 figs., 2 tabs., 10 refs.

In this project partial and total computerized solutions of the interpolation problem have been examined. In the first case tasks were shared between the computer and a hardwired linear interpolator. In the total computer implementation the hardware interpolator is replaced by a software program, which can realize linear and circular interpolation.

A method for implementing position control in the computer is described in a further chapter.

(DM 10,--)

S. Köhle

KFK-PDV 73

"Automatic control and optimization of the electric steelmaking process"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 73, June 1976
47 pages, 15 figures, 3 tables, 31 references

The report outlines the techniques which have been developed within a project for automation of electric steelmaking plant and which have been tested practically using a process computer.

The minimum cost charging materials and alloying additions, respectively, are determined by means of the charge and alloy calculation. Energy distribution control monitors the energy consumption and apportions the disposable energy for melting to the different furnaces according to their priorities at the time. The furnace control traces and records the charging run-off and controls the electric melting power. The averages of the electric arc values are calculated from measured figures.

(DM 5,--)

R. Stimmelmayer, D. Henning

KFK-PDV 74

Fault Diagnosis of Process Automation Systems with Check-out Computer and Fault Reference Listings

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 74, April 1976
34 pages, 10 figs., 4 encls., 4 refs.

Different methods of fault diagnosis for process automation systems are shown. Then a practical example of fault diagnosis with fault reference listings is discussed and the listings evaluated. A description is also given of the hardware and software used for this fault diagnosis.

(DM 10,--)

"Specification CIMIC/1"

KFK-PDV 75

Gesellschaft für Kernforschung mbH, Karlsruhe
PDVreport KFK-PDV 75, May 1976
44 pages

CIMIC/1 (Compiler Internal Machine Independent Code) is a symbolic computer independent intermediate language of assembler level, designed to represent programs, written in ASME-PEARL-Subset/1. It was developed to implement portable compilers. In a first step a PEARL program is translated by the ASME-Stufe 1 - Compiler into CIMIC/1 and in a second step this CIMIC program is translated by a code generator into the assembly language of the relevant target computer.

In this report the intermediate language CIMIC/1 is specified.

(DM 5,--)

ASME-PEARL-SUBSET/1

KFK-PDV 76

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report 76, May 1976
90 pages, 9 references

The present report describes a PEARL subset that was used within the ASME Working Group as a basis for implementation on different target computers. The design of this subset was influenced by various limiting conditions. On the one hand, the user was to be afforded a high degree of programming ease by the widest possible selection of PEARL language features while, on the other, the subset was to be easy to implement. In view of the contrasting requirements for the subset design emphasis was placed for selection on the PEARL language features relevant to real time programming, i.e. the task concept and process I/O (including graphical I/O). Deletions from the full PEARL definition were made principally in the algorithmic section and to a limited extent in the standard I/O. In each case the system section was defined for a specific facility.

(DM 10,--)

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R. Guse, J.C. Promoli, O. Schreiber, G. Schuon

KFK-PDV 77

Automatic control of a ring Spinning machine
Gesellschaft für Kernforschung mbH, Karlsruhe

Report KFK-PDV 77, June 1976
65 pages, 24 figs., 1 table, 12 refs.

The aim of this work was to develop a system for the automatic recognition of thread breaks on the ring spinning frame. A method had to be derived from the statistical behaviour of the thread breaks to control the speed of the spinning frame, so that during the spinning process a constant, as an optimum known rate of thread breaks appears. Because of the extremely high number of spindles on a spinning frame, the development of a very inexpensive method of thread break detection and data reduction had to be found. Solving this problem is possible by means of cheap electronic thread break detectors, which form a ring counter connected with a spinning frame monitor. In the monitor thread breaks are registered as they occur and transmitted to a computer on request. The computer evaluates the necessary correction of the spinning speed from the difference between the nominal and actual number of thread breaks. In addition to thread breaks places in the yarn are registered with optical pick-ups at selected spindles and classified in the monitor. From these data the distribution of thick places is calculated by the computer. This information can be used to adjust the yarn cleaners in the winding process following the spinning process.

(DM 10,--)

Fr. Wick, G. Kögel

KFK-PDV 78

"Module System of Data Terminal"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 78, June 1976
47 pages, 7 Fig., 21 ref.

In this report requirements of a modular system of data terminals for data acquisition and telecommunication are described, and the PAT data terminal system which has been developed under the PDV project is represented.

This module system consists, on the one hand, of simple and price-worthy data processing terminal equipment which can be installed in large quantities in data networks and, on the other hand, of partly autonomic terminal with micro computers for use as data concentrators and intelligent operating data acquisition units.

(DM 5,--)

KFK-PDV 79

E. Franz, W. Fröhlich, R. Hörmann, N. Henkel, R. Butzer

"System Application in Running a Melting Tank"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 79, June 1976
89 pages, 27 figs., 7 references

On the melting tank has been installed a data logger which makes unnecessary the traditional daily recordings. From the data analyses has been elaborated a uniform operating technique for the melting tank tested as well as for other tanks.

A regenerator model could not be applied in practical operation because calibration measurements were impracticable with the given installation.

The digital analytical mathematical models of the melting tank have shown interesting individual perspectives, without having been matured though to an extent making it possible to use them in practical applications.

The cell model as a substantial mathematical model cannot be used on the melting tank for mathematical reasons.

It is safe to assume that, within the next 10 years, there will be no mathematical model of the melting process allowing for on-line control of the same.

(DM 10,--)

U. Gogrewe, A. Schüring, E. Westkämper:

KFK-PDV 80

"Processcomputer material flow control for interlinked, numerically controlled production facilities"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 80, June 1976
99 pages, 50 figs., 5 table, 49 references

The flow of material between interlinked production facilities is of great importance. It is reasonable to control the appropriate transport processes using a process computer. This report deals with the organisational and operational software for the three principal types of flexible manufacturing systems. The results are explained with the help of examples.

Maximum utilisation of the production machines as well as minimum number of paletts and minimum set-up time are the aims of the system organisation. Two models are developed for operational system control: A central process computer control and as an alternative, hierarchially decentralised control with mainly distributed intelligence.

(DM 10,--)

P. Ernst, V. Hartmann:

KFK-PDV 81

"Process Control System for Drilling"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 81, August 1976
55 pages, 28 figs., 6 refs.

At the 'Institut für Mechanische Technologie und Werkzeugmaschinen' a process control system for drilling has been developed. The most important components of the system are a machine for Adaptive Control, sensors for the approach of tool to work, sensors for the components of cutting force and over that an analysis of cutting operation and a method of Adaptive Control. The components are described in following report and their performances are specified.

(DM 10,--)

F. Leonards, W. Müller, F. Otto, H. Sinning:

KFK-PDV 82

Control systems for the turning process

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 82, August 1976
153 pages, 92 figs., 6 tab., 57 refs.

In co-operation with several institutes of the HGF (Hochschulgruppe Fertigungstechnik) computer based control systems for the turning process were developed.

This report deals with strategies, characteristics and sensors for adaptive control systems. The report begins with a survey on Adaptive-Control-Constraint-Systems (ACC) and continues with a detailed description of the realized process-control-systems:

1. Adaptive-Control-Constraint-System (ACC) with automatic Determination of tool pathes.
2. Adaptive Control Optimization (ACO)-System in DNC-mode.
3. Combined ACC-ACO-System. (DM 13,--)

Several authors

KFK-PDV 83

"ACO-controls for milling machines".

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 83, September 1976
175 pages, 66 figs., 42 tabs.

As a common project of several institutes an ACO-pilot-plant for milling has been developed. Components of the system are as follows:

Approach and toolwear sensors, DDC-system for the control of torque and power, programs for avoiding chatter, cut distributions, off- and on-line optimization.

The lay-out and the functioning of the individual components as well as the whole plant are described.

(DM 18,--)

H. Mushardt, E. Scherf, R. Kleensang, R. Bierlich:

KFK-PDV 84

Process Control Systems for Grinding

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV-report 84, September 1976
93 pages, 53 figs., 40 refs.

A report is given of two adaptive control optimization systems for cylindrical plunge grinding. Developed both for rough grinding and finish grinding, the optimization is ground on the mathematic description of the grinding process. Sensors for the cutting force, the wheel wear, the diameter of the workpiece and the surface roughness are watching the process and a computer calculates optimal parameters for grinding and controls the machine. Construction and function of the model systems are described detailed.

(DM 10,--)

D. Stams

KFK-PDV 85

"The market of process control techniques - its present and future structure, aspects related to a funding policy"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 85, July 1976
75 pages, 13 figures

The paper presents the economical importance of testing-, control- and automation-techniques and the importance of the innovation of these techniques by means of computer based information processing. The effect of the innovation upon the structure of the markets is investigated and the thereby related changes of the market-situation are described. From these considerations aspects of innovation-sponsoring are deducted.

(DM 10,--)

G. Spur, W. Adam, H.P. Mattle, A. Pätzold, W. Prehn,
H. Rittinghausen, G. Seliger, W. Wentz, F. Zastrow

KFK-PDV 86

"Basics on Process Automation for Manufacturing"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 86, August 1976
219 pages, 97 fig., 9 Tables, 91 references

In spite of different highly automated components already existing the level of automation for small and medium batch production is low compared with that of mass production. Therefore at the Institute for Machine Tools and Manufacturing Technology of the Technical University of Berlin a system for direct numerical control of discrete NC machine tools (DNC-System) was developed. An extensive automation of communications was achieved by the enlarged DNC-functions of processdata collection and guidance. The project was completed by realizing the first step of a flexible manufacturing system for rotational parts. The efficiency of material flow systems is adapted to that of the highly automated workstations and communications by the automation of transport and handling functions. Means of control, handling, chaining and subsystems, integration shall be tested within this model installation.

(DM 18,--)

H. Burkhardt, H. Altmann, R. Lunderstädt:

KFK-PDV 87

Realization of Optimal Control Problems - Application and Implementation of Modern Control Methods to the Optimal Guidance of Processes

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 87, September 1976
79 pages, 27 figs., 55 references

The application of optimal control theory to realistic problems leads to closed analytical solutions only in a few cases which in addition are mostly of no practical relevance. Therefore, when realizing optimal control special attention must be paid to suboptimal and numerical solutions. This report investigates some methods to solve and realize optimal problems with partly quite different processes and various cost functionals. The main research was concentrated to digital oriented solutions and realizations which are well suited for an implementation on a process computer.

(DM 10,--)

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L. Willner, W. Rademacher, W. Drexler

Application and configuration of hybrid
process control systems
Mathematical models for the cold-rolling process

KFK-PDV 88

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 88, December 1976
58 pages, 9 refs.

This report (KFK-PDV 88) presents a mathematical description
of the cold-rolling process. For this purpose, the cold-rolling
process in a single mill stand is divided into sub-processes.

The corresponding mathematical models are arranged in 6 groups,
namely

1. Model of roll force and torque
2. Models of the entrance- and exit velocities
and of the interstand tension
3. Model of the work roll deformation (profile) and
roll gap change in a 4-high stand
4. Dynamic models of the elastical stand deformation,
the screw actuator and the roll bending system.
5. Approximation of the strip interstand transport delay
6. Model of the electrical mill motors

These six model-groups suffice not only to describe the cold-
rolling process in a single-stand mill but also in a multi-stand
mill.

In report KFK-PDV 89 these model-groups form the basis to
derive a linearized mathematical model of a multi-stand cold-
rolling mill, for which a control system is designed and tested
by hybrid computer simulation.

(DM 10,--)

L. Willner, W. Drexler, W. Rademacher, P. Varhegyi

Application and configuration of hybrid process control
systems / 2
Control and simulation of cold-rolling tandem mill

KFK-PDV 89

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 89, December 1976
61 pages, 5 refs.

Based on the model-groups for a single rolling stand, as
presented in report KFK-PDV 88, a linearized process model
for a 6-stand cold-rolling tandem mill is derived. A hierarchical
control system is designed for the obtained model and tested by
simulation.

The control system is composed by a digital and an analog
controller; the choice of controller type is determined by the
speed of the digital components. The digital controller,
realized by a process computer, is calculating the nominal set
points for the multi-stand mill and is correcting longtime
deviations. The analog controller is needed for controlling
fast changes and disturbances in the stands.

The synthesis of the analog controller is performed in two
steps. First for each stand an optimal control is calculated
which yields, together with a control to counteract interstand
interactions, a suboptimal control for the multi-stand mill.
This theoretically two-level control scheme is then converted
to a suboptimal controller with feedback of output variables
only.

The results are tested by hybrid computer simulation of the
mill model without and with control.

(DM 10,--)

H. J. Gebert, H. Wilhelm, H. Zimmermann

"Modelling and simulation of power plant processes"

KFK-PDV 90

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 90, November 1976
90 pages, 26 figs., 29 refs.

The first part of the paper deals with the basic aspects of
modelling and simulation relating to power plant application,
whereby the main emphasis is given to the systematic approach
for obtaining an economical modelling.

In the second part the results are given obtained with three
different types of power plants:

- DDC-controlled coal-fired steam generator
- combined cycle unit power plant with combustion air
supply by gas turbine and forced-air fan
- pressurized-water reactor power plant with straight-
tube-once through steam generator

It is evident that all existing dynamic problems can be
solved with the presented modelling and simulation methods.
Proposals for an extended economical modelling and optimum
application of simulation are made.

(DM 10,--)

M. Claus, G. Meier, N. Vukas:

KFK-PDV 91

Line Sharing System for Computeroriented Transmission of Process Data

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 91, March 1977
48 pages, 17 figs.

A large number of lines are required in the instrumentation of technological processes between measuring equipment and actuators in the process area and the processing units, display units and operator consoles in the central control room. The development of a process bus is described here which connects up to 1000 participants replacing point-to-point wiring. The functions of data logging, continuous control and sequence control are performed by a mini-computer which acts at the same time as bus driver. Computer and process bus can be built up as double system if required by reliability aspects.

(DM 10,--)

M. Burmeister, P. Günther, R. GÜth, J. Hunger, W. Straßer,
H.-J. Teichmann

KFIK-PDV 92

"Fundamentals for use of displays in process control"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 92, November 1976
220 pages, 77 figs., 3 tabs., 88 references

This report describes the technical feasibilities of video displays, the necessary controls, display processors, storage devices, and interfaces for the use in process control. Examples for hardware realizations are given. Software problems like portability and appropriate data structures are considered theoretically.

(DM 18,--)

L. Felkel, R. Grumbach

KFK-PDV 93

"ALSAN - A System for Disturbance Analysis by Process Computers"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 93, May 1977
38 pages, 11 figs., 17 references

The program system ALSAN has been developed to process the large number of signals due to a disturbance in a complex technical process, to recognize the important (in order to settle the disturbance within a minimum amount of time) information, and to display it to the operators. By means of the results, clear decisions can be made on what counteractions have to be taken. The system works in on-line-open-loop mode, and analyses disturbances autonomously as well as in dialog with the operators.

(DM 5,--)

R. Buck, W. Ruppel, M. Zeitz

KFK-PDV 94

"Dynamical models and simulation of chemical processes"

Part I Catalytic fixed-bed reactors

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 94, October 1976
152 pages, 53 fig., 9 tables, 41 references

A general dynamical model of catalytic fixed-bed reactors is derived which considers the dispersion of mass and energy, the effectiveness factor as well as the catalyst decay. The simulation of the highly nonlinear two point boundary value problems is performed using hybrid and digital methods developed for this purpose. A comparison of the simulation results and the experimental measurements based on a pilot reactor of Farbwerke Hoechst AG enables the verification of the mathematical model. The verified system equations form the basis for the design of control algorithms. Experience with the control of a pilot heat conduction system by means of a process computer is already available.

(Part II Distillation columns KFK-PDV 95) (DM 10,--)

F. Silberberger

KFK-PDV 95

Dynamical models and simulation of chemical processes

Part II Distillation column

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 95, April 1977
125 pages, 52 fig., 26 references

First a general model of a multicomponent distillation column (plate column) is shown. For both phases (vapour and liquid) the material and energy balance equations are considered, the mass transfer is described by mass transfer coefficients.

Then, in order to describe industrial plants, a simplified model is developed, which consists only of the material balance and which considers the energy balance only in an extremely simplified way.

With this simplified model a column for cleaning waste water from the Hoechst Aktiengesellschaft with an extremely nonlinear temperature-profile is simulated and compared with experimental results of the plant. All essential effects of the column are well described.

The most important data about the used computers and about calculation-times are summarized in a small appendix. (DM 12,--)

P. Kneppo

KFK-PD V 96

"Comparison of linear control algorithms for process computers"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 96, October 1976
151 pages, 63 figs., 20 tabs., 37 references

The application of process computers in process control makes it possible to synthesize control algorithms by on line identification of the process (to be controlled) by the process computer itself.

This report describes the synthesis and test of parameter- and structure optimized discrete control algorithms for processes whose models have been obtained by on line identification.

The first step of investigation was the simulation of two test-processes with one input and one output on a CDC 6600 computer. The characteristics of the control loop - control performance, sensitivity, and the computing time for the synthesis between two samples were reported.

In the second step the practical test of the simulation results was performed on a steam heated exchanger controlled by a HP 2100 A computer.

The control on a steam heated exchanger with state controller and observer under different measuring- and sampling times will be shown.

All programs have been written in FORTRAN resp. process-FORTRAN.

(DM 13,--)

E. Bendeich, J. Kölle

KFK-PDV 97

"Aids to the user of process control computers in discrete manufacturing processes"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 97, October 1976
255 pages, 81 fig., 20 tables, 77 references

The following report is a description of aids to support potential users of process control computers in planning and initiating such systems, especially in the field of part-flow-processes like warehousing, transportation, production and testing.

The main parts of the report are the process analysis, system design and selection of a specific computer system for the user's requirements.

All activities of the user starting from the planning to the introduction of the system are described with net-flow-plans and decision-flows.

Furthermore, the present situation of the process control computer application for part-flow-processes is described.
(DM 18,--)

A. Weimann (editor):

KFK-PDV 98

"Simulation and Control of Gas Distribution Networks",
Representation of the Program System GANESI

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 98, December 1976
138 pages, 53 figs., 1 tab., 14 refs.

- Control of gas distribution networks from the view point of operator
- Control of gas distribution networks from the view point of the software producer
- Remarks on the simulation of unsteady flow in gas distribution networks
- The computer program GANESI for the simulation of transient flow in gas distribution networks
- Some aspects of the presentation of the program GANESI on a process computer (DM 13,--)

K. Eibl, A. Weimann

KFK-PDV 99

"Experimental Validation of the Computer Program GANESI"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 99, April 1977
182 pages, 38 figs., 5 tabs., 6 references

The computer program GANESI was designed for the simulation of transient flow in large gas distribution networks with loops. With measurement data from highly transient flow

- in a transport pipeline for refinery gas
- and in a large natural gas distribution network

the accuracy of simulations of transient flow with the program GANESI was proofed. It could be shown that in both cases computed pressures matched the measured pressures within the accuracy of the measurement data.

The validation of the computer program GANESI could be completed with excellent results.

(DM 15,--)

Programmers Handbook for ASME-PEARL-SUBSET/1

KFK-PDV 100

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 100, November 1976
181 pages, 2 figs.

A middle-level programming language is described which allows the formulation of the structure, the algorithms, time behaviour and I/O of realtime programs.

Besides the usual programming aids such as blockstructure, loop-control etc. the language offers the user the important feature of the "Task", which gives the ability to program processes that are parallel in time.

There is a series of statements which give the time-correlation of those tasks, the so called "Tasking". Moreover the structure of connections of standard-I/O-devices and process-control-devices is described by the language, so that all information for the process-control is located in the program.

The language is destined for the process control engineer or experimenter with some programming experience. This report describes the syntax and semantics of the various PEARL-statements and gives examples of them.

(DM 15,--)

Report on the PDV-meeting in November 1976
in Karlsruhe

KFK-PDV 101

"Use of Micro-Processors for Process Control"

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 101, January 1977
450 pages, 176 figures, 20 tables, 121 references

The contributions included in this report represent the essential contents of the corresponding lectures given at the PDV-meeting "Use of Micro-Processors for Process Control" in Karlsruhe on November 3 and 4, 1976. Besides, this report contains lectures which were not presented personally. On the first day the lectures were dedicated to the systemstechnology, on the second day typical examples of application were presented.

(DM 35,--)

S. Köhle, R. Lichterbeck, P. Schmidt

KFK-PDV 102

Energy distribution control in electric steel plant

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 102, December 1976
48 pages, 15 fig., 10 refs.

There is a method described for monitoring and controlling the energy consumption in electric steel plant which has been realized in a plant including four electric arc furnaces with using a process computer. The energy available to the furnaces within a control interval of e. g. 15 minutes after deduction of the power requirements of non-disconnectible consumers is allocated among the different furnaces by adjusting their voltage and by disconnection according to actual priorities. The energy distribution control allows for both lowering of energy costs and reducing of production flow obstructions produced by energy limitations during maximum load periods.

(DM 10,--)

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W. Hofmeister, A. Kantner:

KFK-PDV 103

Mathematical models of power station units with once-through steam generators

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 103, January 1977
64 pages, 14 figures, 30 references

The application of process computers for the automation of power station units enables the economic realization of sophisticated control structures and algorithms. The synthesis of such powerful control systems cannot be carried out on the basis of a vague knowledge of the process. Neither can the control parameters be optimized on the process itself. The design of such highly sophisticated control systems requires theoretical studies and simulations by means of accurate mathematical models of the process.

Although models of power station units have been in use for years, the methods for developing models are still being improved. In particular nonlinear modelling is at an early stage at present.

This report describes the state of the art of linear and nonlinear modelling of the power station process. The models can be applied to conventional and nuclear steam generators. The dynamic response of the linear model has been compared with responses obtained by field tests. The accuracy of the model proved to be satisfactory.

(DM 10,--)

G. Kochen, R.J. Kelm, L. Mayer

KFK-PDV 104

Digital electro-pneumatic positioner

Gesellschaft für Kernforschung mbH, Karlsruhe
Report KFK-PDV 104, December 1976
24 pages, 13 fig., 26 refs.

Within the scope of this project a digital electro-pneumatic positioner for a digital input signal for attachment to diaphragm actuators for control of valve position has been conceived, developed and designed.

The laboratory sample is consisting in the modules:

- digital position signalizer
- digital comparator
- digital controller
- module for control by solenoid valve battery

Satisfactory results have been achieved with respect to static and dynamic behaviour. They are in good conformity with theoretical and practical preliminary research taken by means of a simulation model.

The principle used allows positioning control by local controller as well as by central computer.

(DM 5,--)

N. Korn, W. Ziegler:
Transmitters for mechanical Magnitudes
Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 105, December 1976
19 pages, 3 figs.

KFK-PDV 105

Within the scope of this project pressure measuring devices with digital output signal have been conceived, developed and designed which seem to render it possible to produce on an economic base within a reasonable time reliable measuring transmitters on this principle meeting the extreme demands implied by the range of application. To solve these problems the following activities have been executed:

1. Fundamental researches in principal methods
2. Comparison and evaluation of these methods with respect to efficiency and ability of realization
3. Performing and examination of two test assemblies
4. Evaluation of utility of both test assemblies

Under consideration of the marginal conditions to use the measuring transmitters in digital control systems and in the chemical process control the following structures have been examined:

- measuring transmitters with conventional pressure sensing systems and AD-transducers
- pressure transmitters with a frequency output signal depending on the measured magnitude
- measuring transducers with direct AD-conversion without electrical intermediate signal

A comparison of the results of examination proves that a measuring transmitter which meets all demands stipulated can at present be realized best with conventional pressure sensing system and AD-converter.

(DM 10,--)

E. Dittmar, H.-J. Kiersch, U. Schmudlach, J. Weihrauch:
New Concepts of Control Centre Design and Development

KFK-PDV 106

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 106, February 1977
123 pages, 22 fig., 2 refs.

This report shows the concept of modern control centre technology and describes its realization at project including the supervision of an electric power distribution system.

A modern control centre is characterized by the fact that conventional control elements are more and more replaced by elements of computer technology, i.e. computers and displays. The different functions implemented by hard- and software set new standards relative to flexibility, adaptability, dimensioning. The communication interface man/process is defined and designed in a new way allowing a dynamic and more efficient supervision strategy of technical processes via display in different operation modes.

Special attention is paid to adjustments and extensions of process elements and their integration into the supervised network.

(DM 12,--)

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G. Stute, A. Storr, D. Binder, W. Döttling, H. Fink, J. Firnau,
A. Herrscher, H. Wörn:

KFK-PDV 107

Basic Considerations in the Automation of Manufacturing Process
Controls (for Flexible Manufacturing Systems)

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 107, February 1977
124 pages, 55 figs., 4 tabs., 23 refs.

The application of realtime computers in the area of manufacture for the control of individual NC machines was, up to now, limited mainly to the storage and distribution of control data in so-called DNC (Direct Numerical Control) Systems. An extension of the DNC systems aims at improved economic benefit by the inclusion of additional functions from elsewhere as well as functions not automated up to now. Here control functions which occur frequently in the machine sphere are transferred to the central processing computer. Functions which have not been automated up to now are, for instance, those concerned with workflow organization and production data acquisition. In Flexible Manufacturing Systems these functions have to be automated. A control system for a Flexible Manufacturing System has been developed and built at the Institut für Steuerungstechnik der Werkzeugmaschinen und Fertigungseinrichtungen at Stuttgart University. It has a hierarchical structure and groups the recurring functions together in units. The application of the results should not be limited to Flexible Manufacturing Systems. Basic considerations and results of the development are described.

(DM 12,--)

S. Köhle:

KFK-PDV 108

Bases of the high-current system of arc furnaces

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report, KFK-PDV 108, March 1977
95 pages, 11 figs., 3 tabs., 22 refs.

The relations between the inductances of the loops are studied, which are formed by the three high-current lines and a measuring line connected to the vessel. It is shown how the inductance values measured in single-phase short circuit shall be corrected so that they become compatible. An equivalent circuit diagram proposed in the literature and the known methods for measuring instantaneous values of the electric arc variables are described. Two other methods are indicated allowing to calculate approximately the mean values of the arc variables assuming linear conditions.

(DM 10,--)

Proceedings of a Symposium about PEARL in Augsburg, March 1977

KFK-PDV 110

Gesellschaft für Kernforschung mbH, Karlsruhe
KFK-PDV 110, March 1977

Both, the PDV Project Management of Gesellschaft für Kernforschung mbH, Karlsruhe, and the VDI/VDE-Gesellschaft Meß- und Regelungstechnik, are organizing on March 9, 1977, a public symposium about PEARL, the unified realtime programming language in the Federal Republic of Germany. This report contains papers of speeches given at the symposium about the following topics:

- The sponsoring of PEARL within the Project PDV (history, status, future, standardization),
- PEARL as compared with other realtime languages,
- Experiences with present PEARL subsets (both in laboratory and industrial environment).

(DM 10,--)

H. Birck, H.G. Jacob, G. Schmidt:

KFK-PDV 111

Digital control of domestic oil burners reduces air pollution

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 111, May 1977
56 pages, 17 figs., 7 tab., 38 refs.

After a brief description of the working of oil heating plants for domestic use, experimentally obtained families of curves showing the performance of the heating plant, with respect to pollution as well as consumption of oil, are explained. A corresponding quality criterion is derived. The simulation investigations are based on mathematical models of a standard domestic oil heating installation and of the time sequences of the typical perturbations acting on the plant.

Simulation runs on heating installations without control process equipment are compared with simulation runs using programs for extremum seeking control, automatic starting commands, and self surveillance devices. The results demonstrate the effectiveness of such concepts particularly with respect to pollution suppression. The results of on line extremum seeking control by a microcomputer controller coincide with the previous simulation runs. It is shown, that digital control of domestic oil burners by microcomputers is technically and economically feasible.

(DM 10,--)

H.-D. Bauermann:

KFK-PDV 112

Simulation and mathematical modeling of pulsed counter-current extractors

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-report KFK-PDV 112, April 1977
170 pages, 46 figs., 10 tabs., 106 refs.

For a pulsed sieve-plate-extraction column, operating in the technical interesting dispersion region, a mathematical model was built to simulate the dynamic behaviour by changing inputs (concentration- and flow rate disturbances in raffinate and extract, pulsating disturbances).

The parameters of the model (e.g. backmixing, holdup, efficiency) were estimated from correlations to consider the mutual dependence. It is demonstrated that the extraction column can be approximated by a system of second order with two equal time-constants and the dead-time, whereby the characteristic time values can be correlated with the changing input parameters. The reduced model is the base for a feed forward control with a microprocessor, as well as for a simplified analysis of the dynamic behaviour.

(DM 15,--)

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Budde, W.; Ernst, G.; Imbusch, K.:

KFK-PDV 114

Simulation of a Manufacturing System Shown With the Example
of Graphic Verification of Control Data for NC Machine Tools

Gesellschaft für Kernforschung mbH, Karlsruhe

PDV-report KFK-PDV 114, July 1977

131 pages, 41 figs., 32 refs.

The present research report describes a program system that simulates graphically the process of operations on numerically controlled machine tools with the aid of control data, the latter being alternatively the output of APT-like NC-processors as well as manually prepared control programs. The formal, logical and graphical verification of the control data enables to reduce direct and indirect production costs and brings about a rationalization effect in manufacture.

(in preparation)

KFK-PDV 120

Basic PEARL Language Description

Gesellschaft für Kernforschung mbH, Karlsruhe
PDV-Report KFK-PDV 120, 1977

This document is the official common language description of Basic PEARL. Basic PEARL is the subset of Full PEARL which was defined as the minimum that each PEARL implementation must contain. At the time being, it has been accepted and included in their implementations by the following firms: AEG, BBC, Dietz, GPP, Krupp-Atlas, MBP, and Siemens.

(For Full PEARL, refer to Language Description KFK-PDV 130, Gesellschaft für Kernforschung mbH, Karlsruhe.)

(DM 30,--)