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AIR FORCE FLIGHT DYNAMICS LABORATORY
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WRIGHT PATTERSON AIR FORCE BASE OHIO

A USER'S MANUAL FOR THE SEQUENCE ACCOUNTABLE FATIGUE ANALYSIS COMPUTER PROGRAM

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FORWARD

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This Technical Memorandum has been reviewed and is approved.

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ABSTRACT

This report presents a detailed description of a computer program to calculate cumulative damage of notched structural members subjected to arbitrary spectra. The Sequence Accountable Fatigue Analysis computer program develops its sequence sensitivity by tracking residual stresses local to a notch throughout the spectrum of loads. Residual stress relaxation analysis is included to increase the generality of the results. An example spectrum and resulting cumulative damage analysis are illustrated.

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SYMBOLS

σ_{res}	Residual stress
σ_{max}	Maximum local stress level
σ_{min}	Minimum local stress level
σ_{ys}	Yield stress
$\sigma_{res_{EQ}}$	Equilibrium component of the residual stress
ε_t	Local strain, total
ε_e	Elastic component of total strain
ε_p	Plastic component of total strain
S_{max}	Maximum applied stress level
S_{min}	Minimum applied stress level
S_{mean}	Mean applied stress level, $(S_{max} + S_{min})/2$
K_t	Elastic stress concentration Factor
D	Damage
I	Integer describing the level number
N_{EP}	Equilibrium period, number of cycles for the local stresses to return approximately to the equilibrium conditions following an overload
C1	Residual stress relaxation constant
E1, E2	Relaxation function exponents
N	Number of cycles
E	Modulus of elasticity
N_f	Number of cycles of life at a given stress or strain cycling level
ε_f'	Strain intercept at one reversal on a log ε_p-log life curve
c	Slope of the log ε_p-log life curve

SECTION I

INTRODUCTION

Cumulative damage analyses based upon the local stress-strain behavior at a notch appear to be reasonably successful in anticipating trends in fatigue life behavior of notched specimens subjected to spectrum loading [1-6]. The type of behavior that usually occurs is that peak tensile loads tend to increase the fatigue life and peak compressive loads tend to decrease the life of notched structures compared to structures experiencing load spectra not having those peaks [5,6]. Local behavior analyses, such as those developed by Smith [7] and Neuber [8], help to explain this phenomenon as being a result of the tensile peak load creating a compressive residual stress at the notch and, conversely, the compressive peak creating a tensile residual stress. The change in life occurs because the residual stress state modifies the subsequent damage accumulation rates.

The Sequence Accountable Fatigue Analysis computer program was developed to incorporate the local stress-strain approach with a recent residual stress relaxation analysis [6] in order to improve the sequence sensitivity of cumulative damage analysis. This technical memorandum presents the details of the resultant computer program and an example of its use. The correlation of predictions made with this analysis to actual results of tests experiencing spectrum loading is presented by Potter [9] and Potter and Noble [10].

SECTION II

PROGRAM OUTLINE

The Sequence Accountable Fatigue Analysis traces the stress-strain behavior local to a notch throughout an applied load spectrum and calculates the damage based on the local experience. The computer program is divided generally into the four parts or modules outlined in Fig. 1.

The basic input data for the material, specimen geometry, fatigue behavior qualities and spectrum, are developed in Module I. Module I is discussed further in Section III. Module II takes the input information and determines the local stress-strain behavior. Module III references the Range Pair Counting Method Subroutine to cycle count the local stress spectrum. Module IV determines the damage in the local stress-strain spectrum.

The basic analyses used in Modules II, III and IV are presented below.

<u>Module II - Local Stress-Strain Behavior</u> - The analysis used during the determination of the local stress behavior during the spectrum of loading is a combination of analyses developed by Smith [7], Neuber [8] and Potter [6]. Smith's simple analysis indicated that the residual stress could be approximated by assuming that the initial stress-strain behavior was elastic upon unloading following plastic flow. Thus, the residual stress could be calculated knowing the

maximum local stress and the maximum applied stress as in Eq. 1 and in Fig. 2.

$$\sigma_{res_i} = \sigma_{max_i} - K_t S_{max_i} \qquad (1)$$

The Sequence Accountable Fatigue Analysis computer program currently incorporates elastic-perfectly plastic stress-strain behavior. Therefore, σ_{max_i} is equal to the yield stress. For the cycles immediately following the peak stress, the residual stress determined in Eq. 1 modifies the elastic solution as shown in Eqs. 2 and 3 (provided that the following maximum applied stress is less than S_{max} and that there is no change in the residual stress due to a minimum applied stress causing reversed yielding).

$$\sigma'_{max_i} = \sigma_{res_{i-1}} + K_t S_{max_i} \qquad (2)$$

$$\sigma_{max_i} = \sigma_{res_{i-1}} + K_t S_{max_i} \qquad (3)$$

The analysis developed by Neuber [8] has been extended to cyclic loading by Wetzel [2] and Wetzel, Morrow and Topper [3] and used by many others [1,4-6] primarily to determine local stress-strain behavior. It is used in this program only to calculate plastic strains occurring when the residual stress undergoes a step change. The plastic strain calculation routine is accessed only when the σ_{max_i} or σ_{min_i} terms in Eqs. 2 and 3 exceed tensile or compressive yield stress levels, respectively. Figure 3 illustrates the calculation of the plastic strain.

The local stress-strain behavior, according to Wetzel [2] is related to the applied load by Eq. 4

$$\sigma \cdot \varepsilon = (K_t S_{max})^2 / E \qquad (4)$$

The plastic strain can be found by subtracting the elastic component from the total strain.

$$\epsilon_p = \epsilon_t - \epsilon_e = (K_t S_{max})^2/E\cdot\sigma_{max} - \sigma_{max}/E$$

Therefore, the plastic strain associated with S_{max_i} is given in Eq. 5.

$$\epsilon_{p_i} = (K_t S_{max_i})^2/E\sigma_{ys} - \sigma_{ys}/E \qquad (5)$$

If a residual stress existed prior to this plastic strain excursion, the plastic strain associated with that prior excursion is subtracted from Eq. 5 as shown in Eq. 6.

$$\epsilon_{p_i} = (K_t S_{max_i})^2/E\sigma_{ys} - (\sigma_{ys} - \sigma_{res_{i-1}})^2/E\sigma_{ys} \qquad (6)$$

A similar calculation is made for plastic strains occurring during the minimum stress peak.

In the analysis developed by Potter [6] the residual stress cyclically relaxes toward zero or an equilibrium residual stress as shown in Fig. 4 according to Eq. 7.

$$\sigma_{res_{N=1,2,\ldots}} = (\sigma_{res_{N=1}} - \sigma_{res_{EQ}})\exp(N/N_{EP_i}\ln(0.1)) \qquad (7)$$

The N_{EP} term, the Equilibrium Period, is dependent upon the applied stress and the Residual Stress Relaxation Constant.

$$N_{EP_i} = (C1/(K_t S_{max_i}^{E1}\cdot K_t S_{mean_i}^{E2})) \qquad (8)$$

The Residual Stress Relaxation Constant, C1, has not yet been experimentally defined but should be a constant for a material.

<u>Module III - Cycle Counting Method</u>

After the local stress and plastic strain behavior is calculated, the local stress spectrum is Range Pair Counted using a computer program developed by Tischler.[11]

Module IV - Damage Calculation

Damage is calculated separately for the plastic strain excursions and the elastic stress spectrum. The damage is determined from the conventional $D = \sum \frac{n}{N}$ calculation. Damage from each of the plastic strain cycles is determined from the Coffin-Manson [12] form.

$$D_i = 1./N_{f_i} = 1./(\varepsilon_{p_i}/\varepsilon_{f'})^{1/c}$$

Damage from the elastic stress cycles is determined in a similar manner. The maximum and minimum local stress levels are sequentially compared to unnotched S-N data in a Modified Goodman Diagram format. Damage is summed, and failure of the coupon is defined as the event occurring when the summed damage equals unity.

SECTION III

INPUT DATA REQUIREMENTS

In general, each spectrum analyzed will require slightly different programming in order to get the load history into a usable format for the core program. The basic program requires a certain family of information before any analytical predictions can be made. Appendix I contains a program listing for the Sequence Accountable Fatigue Analysis. The subroutine CORE which accesses the subroutines having to do with RPCM, the Range Pair Counting Method, contains the basic analysis. Subroutine SAL reads the data input and then references subroutine CORE. The subroutine SAL shown is one in which a block of cycles is repeated with optional cycles. A list of the input data cards and the resulting analysis is given in Appendix II.

The specific data requirements are given below.

1. Stress-Strain Behavior - The stress-strain behavior is presumed to be elastic - perfectly plastic with the tensile yield stress being equal to the compressive yield stress. The yield stress value used is an average of the monotonic behavior generally being above the 0.2% yield value and below the engineering ultimate strength.

2. Residual Stress Relaxation - The residual stress relaxation behavior of Eq. 7 and 8 is characterized by C1, the Residual Stress Relaxation Constant and E1 and E2, the relaxation equation exponents. The Residual Stress Relaxation Constant, C1, has not yet been adequately determined. It should be a material property if the relaxation function

is correct and must be assumed. A reasonably accurate estimate of the Residual Stress Relaxation Constant for aluminum material falls in the range of 5-20 x 10^6 (cycles) $(Ksi)^2$. Further experimentation on the part of the analyst should develop a C1 usable for his set of conditions until actual measurement of residual stress relaxation behavior defines the relaxation function and constants. At present E1 and E2 are considered to be equal to 1.0.

3. Specimen Geometry - The elastic K_t value (if available) is entered into the analysis. If that value is not available then an estimate from some other method may be used. In certain cases, a value may be determined from a constant amplitude fatigue test of a similar structure by fitting several values of K_t to the analysis and determining the best correlation as is done with the K_f solution. Once a stress concentration factor, K_t, is determined for a specimen, that value is not changed from test-to-test of the same coupon configuration.

4. Load Multiplier - Different spectra are presented for analysis in different manners. Some data are presented in percent of maximum stress, others in terms of nominal stress, and others in terms of bending moment. The value of the load multiplier defines the nominal stress history.

5. Cumulative Damage Analysis - The damage from the range-paired elastic stress spectrum is determined by calculating a simple $\frac{n}{N}$ value for each level and accumulating the total. The N_{f_i} value is determined from unnotched coupon S-N data in the Modified Goodman Diagram format.

The program requires the input of four second order equations describing the maximum and minimum stress levels at lives of 10^4, 10^5, 10^6 and 10^7 cycles. The coefficients of the equations are derived by least square fitting the S-N data presented in the form of Eq. 9.

$$S_{max} = A(I) S_{min}^2 + B(I) S_{min} + C(I) \qquad (9)$$

The A, B, and C coefficients for several typical materials are presented in Appendix IV. The S-N data shown was derived from various sources but usually from the MIL-HDBK-5A [13]. The C coefficients correspond to the maximum stress level at zero to maximum applied stress conditions on the unnotched coupons.

The damage from the plastic strain cycles is determined using the Coffin-Manson relation to calculate the N_{f_i} value. The conventional plastic strain intercept at one reversal and the ε_p - life slope values are used in the analysis. Specific measured values from the literature are used when available and typical values when they are not available.

6. Analysis or Test Spectrum - The last information needed is the order and magnitude of application of the spectrum used in the test.

SECTION IV

OUTPUT OPTIONS

The Computer Program prints the following output in the process of the analysis.

1. Maximum and minimum applied stress and local stress response through the spectrum. Also printed out is the residual stress, equilibrium stress, applied cycles, and the equilibrium period.

2. The elastic local stress history as input into the Range Pair Subroutine and the resulting Range Paired spectrum.

3. The plastic strain occurrence during the spectrum and the damage associated with each strain reversal.

4. The accumulated damage associated with the plastic strains.

5. The Range Paired elastic stress spectrum and the damage associated with each level.

6. The accumulated damage associated with the current block of loading including the plastic strain damage and the total damage since the initiation of cycling.

At the option of the analyst, he can print out all the above items or only two. The IPRINT value controls what data is printed.

If IPRINT = 1, all six items are printed for each flight or block.

If IPRINT = 2, all items except 2. above are printed.

If IPRINT = 3, only items 4. and 6. above are printed.

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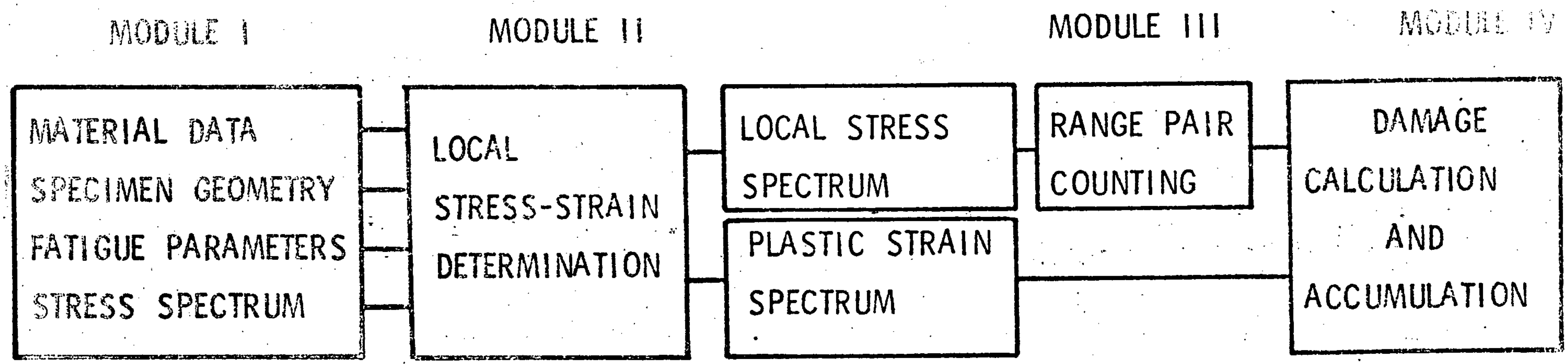

FIGURE 1. PROCEDURE USED IN THE SEQUENCE ACCOUNTABLE FATIGUE ANALYSIS

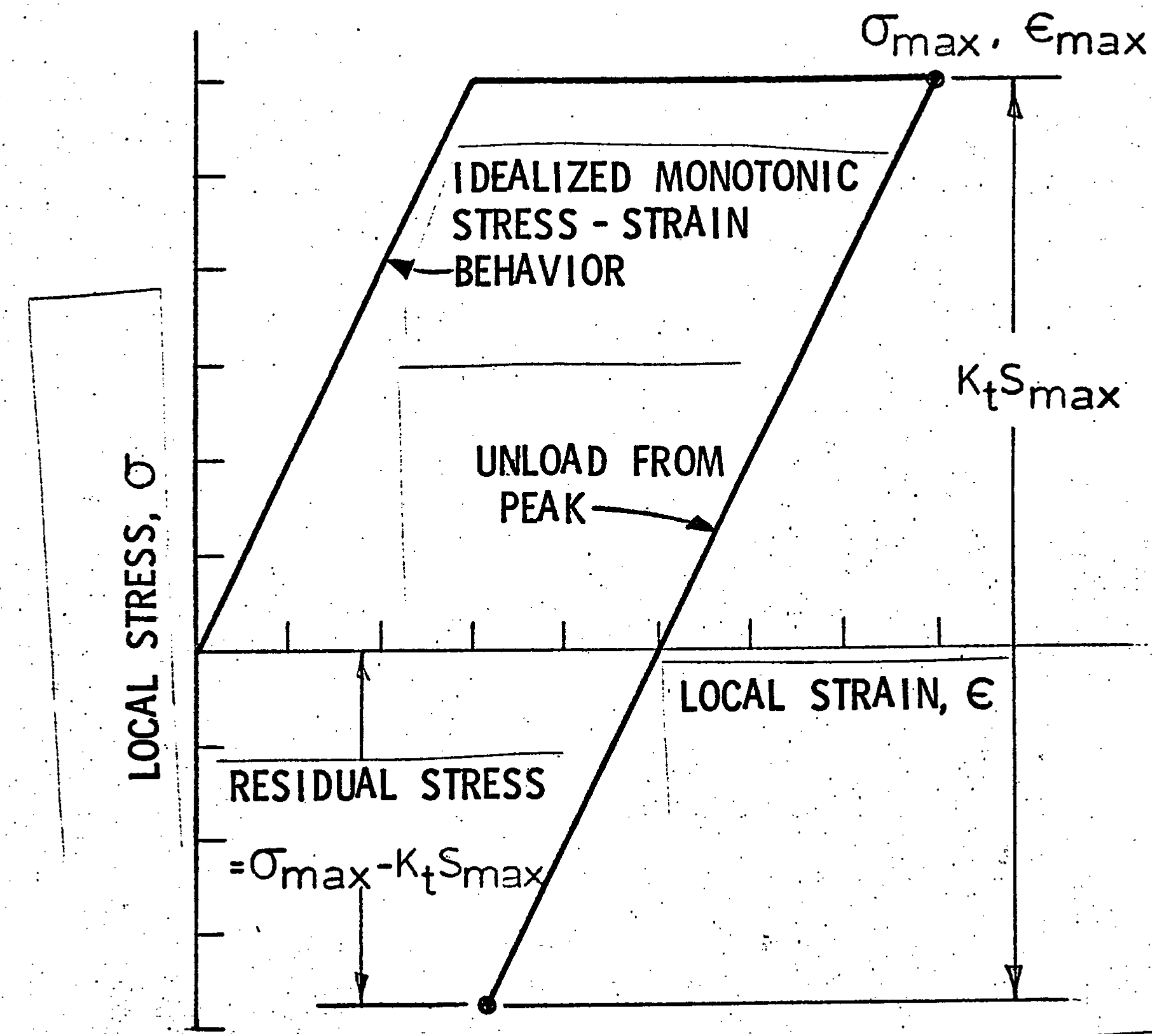

FIGURE 2. METHOD OF DETERMINING THE RESIDUAL STRESS FOLLOWING A PEAK LOAD

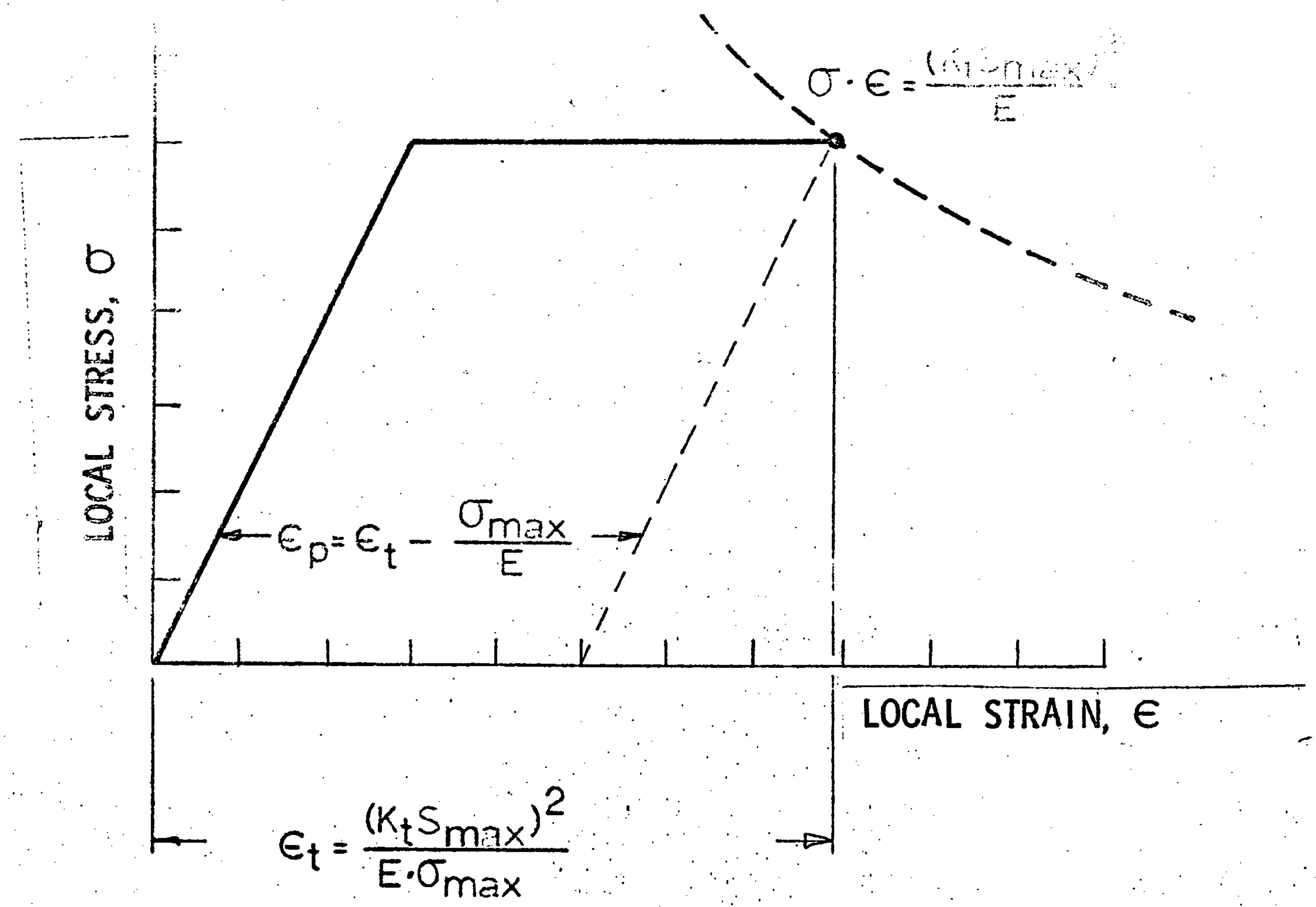

FIGURE 3. METHOD OF DETERMINING PLASTIC STRAIN LEVELS

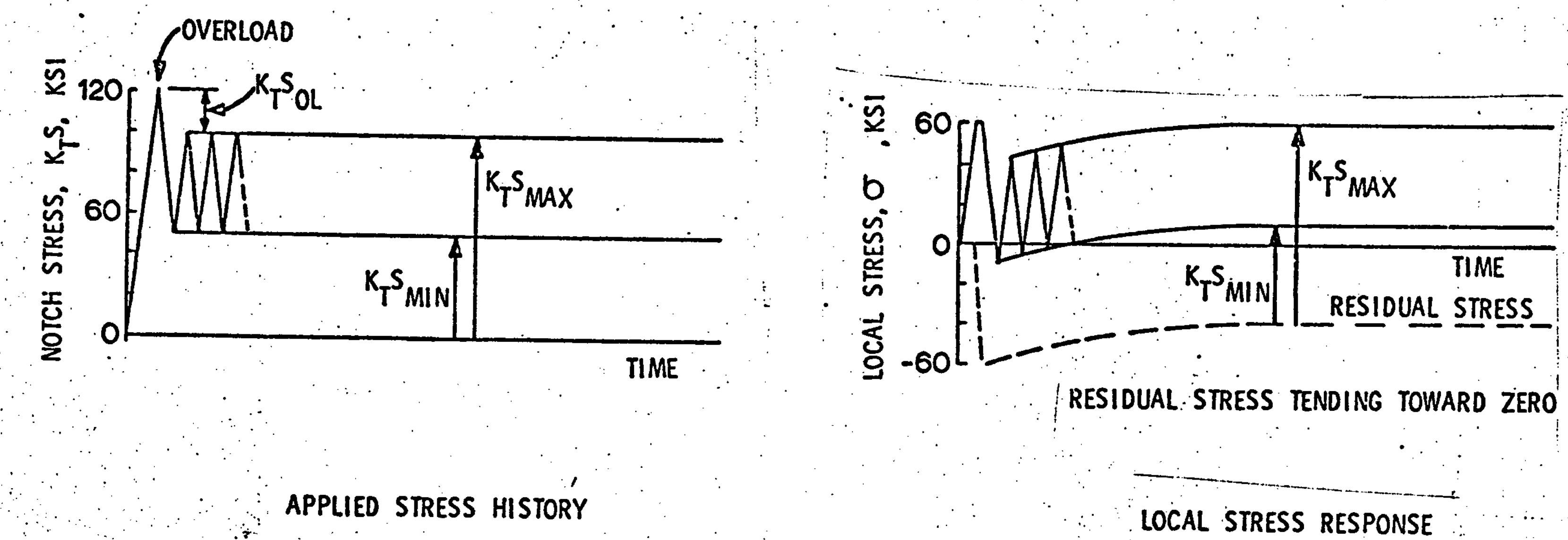

FIGURE 4. LOCAL STRESS RESPONSE FOR APPLIED CONSTANT AMPLITUDE LOADING WITH RESIDUAL STRESS RELAXATION

APPENDIX I

PROGRAM LIST


```
      PROGRAM SAL(INPUT,TAPE5=INPUT,OUTPUT,TAPE6=OUTPUT)
C
C     *******************************************************************
C
C                          MODULE I
C                   INPUT ROUTINE FOR THE
C       SEQUENCE ACCOUNTABLE FATIGUE ANALYSIS
C
C     *******************************************************************
C
C              PROGRAM DEVELOPED BY   JOHN M. POTTER AND ROBERT A. NOBLE
C                  OF THE AIR FORCE FLIGHT DYNAMICS LABORATORY
C                       MARCH 1973
C                    ADDRESS: AFFDL/FBR
C                               WRIGHT-PATTERSON AFB,OHIO  45433
C                    TELEPHONE  (513) 255-5194  OR  255-6105
C
C     INPUT
C
C
C     DATA CARD 1.      NDECK = THE NUMBER OF DATA DECKS TO BE RUN SEQUENTIALLY.
C                       IPRINT   THE VALUE CONTROLLING THE WRITE STATEMENTS
C                                  1  PERMITS MAXIMUM PRINTOUT
C                                  2  SUPPRESSES RAINFLOW PRINTING
C                                  3  MAXIMUM SUPPRESSION OF PRINTOUT
C                       IRPCM= THE VALUE CONTROLLING THE ENTRY INTO THE
C                              RANGE PAIR COUNTING SUBROUTINE
C                                  1  ENTER RANGE PAIR COUNTING SUBROUTINE
C                                  2  SKIP RANGE PAIR COUNTING SUBROUTINE
C                       FORMAT  3I4
C
C     EACH DATA DECK CONTAINS THE FOLLOWING CARDS --
C
C     CARD 1.         TEST IDENTIFYING INFORMATION
C                     FORMAT  8A8
C
C     CARD 2.         TM     = MATERIAL TYPE
C                     TYS    = TENSILE YIELD STRESS (KSI)
C                     EPSD   = LCF STRAIN INTERCEPT
C                     COFMAN = INVERSE OF COFFIN-MANSON SLOPE
C                     ELMOD=  MODULUS OF ELASTICITY  (KSI)
C                     FORMAT 2A8,3F18.5,F10.2
C
C     CARDS 3,...,6.  A(N)   N=4,7    (A,B,C ARE COEFFICIENTS OF SECOND
C                                     (ORDER LEAST SQUARE FIT OF S-N DATA,
C                     B(N)            (FOR CURVE OF 10**N CYCLES.)
C                     C(N)            (STMAX = A(N)*STMIN**2 + B(N)*STMIN + C(N))
C                     TITLE1          (TITLE1,TITLE2 IDENTIFIES THE      )
C                     TITLE2          (SOURCE OF THE S-N DATA            )
C                     N               (PUNCHED IN COLUMN 72. FOR INFO.)
C                     MATERIAL TYPE   (COLUMNS 73-80. FOR INFO ONLY.   )
C                     FORMAT 3F18.5,2A8
C
C     CARD 7.         C1              (CONSTANTS TO BE USED IN CALCULA- )
```

```
C                    E1                  (TION OF EQUILIBRIUM PERIOD, ENEP.)
C                    E2                  (ENEP=C1/(KTSMAX**E1*KTSMEAN**E2) )
C                    FORMAT  3F18.5
C
C      CARD 8.       AKT = STRESS CONCENTRATION FACTOR USED THE FIRST
C                          TIME THROUGH THE PROGRAM
C                    ZKT = STRESS CONCENTRATION FACTOR USED THE LAST
C                          TIME THROUGH THE PROGRAM
C                    DELAKT = STEP CHANGE IN KT BETWEEN RUNS
C                    FORMAT  3F18.5
C
C      CARD 9.       NBLOCK = NUMBER OF BLOCKS (NO. OF TIMES TO REPEAT LIST
C                                                            OF LOADS)
C                    NLEVEL = NUMBER OF LOADS
C                    NTYPE  = NUMBER OF TYPES OF LOADS
C                    FORMAT  3I10
C
C      CARD 10.      TLL = LIMIT LOAD
C                    FORMAT  F18.5
C
C      CARDS 11,....,NLEVEL + 10.
C                    ISTEP(K) = K = THE KTH STEP       (K=1,NLEVEL)
C                    ITYPE(K) = THE IDENTIFYING TYPE OF THE KTH LOAD
C                    STMIN(K) = THE KTH MINIMUM (DECIMAL FRACTION OF TLL)
C                    STMAX(K) = THE KTH MAXIMUM (DECIMAL FRACTION OF TLL)
C                    ENN(K)   = NUMBER OF CYCLES AT THE KTH LOAD
C                    FORMAT  2(I4,2X),3(F18.5,1X)
C
C      CARDS NLEVEL + 11,....,NLEVEL + 10 + NBLOCK.
C                    IBLOCK(JJ) = JJ = THE JJTH BLOCK       (JJ=1,NBLOCK)
C                    NN(JJ,1)   = TYPE OF LOAD INCLUDED IN JJTH BLOCK
C                    NN(JJ,2)   =          (THERE WILL BE ONE NN VALUE       )
C                    NN(JJ, )   =          (ON THE CARD FOR EACH DIFFERENT )
C                    FORMAT  9I5           (TYPE OF LOAD INCLUDED IN THE    )
C                                          (JJTH BLOCK                      )
C
      COMMON/MSAL/RNCYC(200),KPMAX,IPRINT
      DIMENSION RTMIN(200),RTMAX(200),RNN(200),ITYPE(200)
      COMMON/MCOR1/NLEVEL,IRPCM,IPLOT,ELMOD,TYS,EPSD,COFMAN,C1,E2,E1,
     *RES(200),AKT,SUMENN,SUMNC
      COMMON/MCOR2/STMIN(200),STMAX(200),ENN(200),A(10),B(10),C(10),
     *R(10),ISTEP(200),NN(200,10),IBLOCK(200)
      READ(5,4) NDECK,IPRINT,IRPCM
    4  FORMAT(3I4)
      WRITE(6,3) NDECK
    3 FORMAT(1H1,I4,32H DATA DECKS ARE TO BE PROCESSED.)
      IF(IRPCM.GE.2)GO TO 6
      WRITE(6,11)
      GO TO 13
    6 WRITE(6,7)
    7 FORMAT(25H NO COUNTING METHODS USED)
   13 CONTINUE
      DO 595 LMN = 1,NDECK
      WRITE(6,5)
    5 FORMAT(40H SEQUENCE ACCOUNTABLE FATIGUE EVALUATION)
```

```
      READ(5,9)T1,T2,T3,T4,T5,T6,T7,T8
    9 FORMAT(8A8)
      WRITE(6,8)T1,T2,T3,T4,T5,T6,T7,T8
    8 FORMAT(16H1SPECTRUM FROM   ,8A8)
C
C          INPUT OF DATA PECULIAR TO A MATERIAL
C
      READ(5,10)TM1,TM2,TYS,EPSD,COFMAN,ELMOD
   10 FORMAT(2A8,3F18.5,F10.2)
      WRITE(6,12)TM1,TM2,TYS,EPSD,COFMAN,ELMOD
   12 FORMAT(18H MATERIAL TYPE -- ,2A8,//30H TENSILE YIELD STRESS (KSI)
     *--,F18.5,//23H LCF STRAIN INTERCEPT =,F18.5,//31H INVERSE OF COFFI
     *N-MANSON SLOPE,F18.5,//18H ELASTIC MODULUS =,F18.5)
      READ(5,14) (A(N),B(N),C(N),TITLE1,TITLE2,N=4,7)
   14 FORMAT(3F18.5,2A8)
      WRITE(6,16)
   16 FORMAT(58H0COEFFICIENTS OF SECOND ORDER LEAST SQUARE FIT OF S-N DA
     *TA)
      WRITE(6,18)
   18 FORMAT(44H        SMAX = A(I)*SMIN**2 + B(I)*SMIN + C(I))
      WRITE(6,20)
   20 FORMAT(5X,5H LIFE,10X,5H A(I),14X,5H B(I),14X,5H C(I))
      WRITE(6,22)(N,A(N),B(N),C(N),N=4,7)
   22 FORMAT(8H    10**,I2,3F18.5)
      WRITE(6,56) TITLE1,TITLE2
   56 FORMAT(39H0UNNOTCHED COUPON S-N DATA DERIVED FROM/28H INFORMATION
     *SUPPLIED FROM   ,2A8)
      READ(5,14) C1,E1,E2
      WRITE(6,24)
   24 FORMAT(36H0RESIDUAL STRESS RELAXATION FUNCTION)
      WRITE(6,26)
   26 FORMAT(/42H        ENEP = C1/(KTSMAX**E1 * KTSMEAN**E2)/)
      WRITE(6,28) C1,E1,E2
   28 FORMAT(13H WHERE   C1 =,E15.8,9H ,    E1 =,F10.3,10H AND  E2 =,F10.
     *3)
C
C
C
C          INPUT OF DATA PECULIAR TO A SEQUENCE
C
C
      READ(5,65)AKT
   65 FORMAT(F18.5)
      READ(5,32) NBLOCK,JLEVEL,NTYPE
   32 FORMAT(3I10)
      WRITE(6,34) NBLOCK,JLEVEL
   34 FORMAT(// I10,23H TIMES THROUGH BLOCK OF,I10,6H LOADS)
      READ(5,35) TLL
   35 FORMAT(F18.5)
      WRITE(6,33) TLL
   33 FORMAT(/ 5X,13H LOAD LIMIT =,F18.5)
      READ(5,36)(ISTEP(K),ITYPE(K),RTMIN(K),RTMAX(K),RNN(K),K=1,JLEVEL)
   36 FORMAT(I4,2X,I4,2X,F18.5,1X,F18.5,1X,F18.5,1X)
      WRITE(6,38)
   38 FORMAT(//11H STEP  TYPE,10X,6H STMIN,14X,6H STMAX,15X,4H ENN)
```

```
      WRITE(6,36)(ISTEP(K),ITYPE(K),RTMIN(K),RTMAX(K),RNN(K),K=1,JLEVEL)
      WRITE(6,39)
   39 FORMAT(//47H BLOCK  TYPE TYPE TYPE TYPE TYPE TYPE TYPE TYPE/)
      DO 42 JJ=1,NBLOCK
      READ(5,40) IBLOCK(JJ),(NN(JJ,KK),KK=1,NTYPE)
      WRITE(6,40) IBLOCK(JJ),(NN(JJ,KK),KK=1,NTYPE)
   40 FORMAT(9I5)
   42 CONTINUE
      SUMENN=0.
      SUMNC=0.
      RES(1)=0.
       WRITE(6,8)T1,T2,T3,T4,T5,T6,T7,T8
      WRITE(6,51) (AKT)
   51 FORMAT(/7H AKT = ,(F6.2))
        WRITE(6,55)C1
   55 FORMAT(//24H RELAXATION CONSTANT C1=,F15.2)
       IF(IRPCM.GE.2)GO TO 59
      WRITE(6,11)
   11 FORMAT(56HOSPECTRUM SUBJECTED TO THE RANGE-PAIR COUNTING TECHNIQUE)
     *)
   59 CONTINUE
      DO 1002 KFL=1,NBLOCK
       JJJ=1
      DO 60 J=1,JLEVEL
      DO 70 KK=1,NTYPE
       IF(NN(KFL,KK).EQ.0) GO TO 60
       IF(ITYPE(J).EQ.NN(KFL,KK))GO TO 150
   70 CONTINUE
  150  STMIN(JJJ)=RTMIN(J)*TLL
       STMAX(JJJ)=RTMAX(J)*TLL
       ENN(JJJ)=RNN(J)
      JJJ=JJJ+1
   60 CONTINUE
       NLEVEL=JJJ-1
      CALL CORE(KFL)
       IPRINT=2
 1002 CONTINUE
  597 CONTINUE
  595 CONTINUE
  596 CONTINUE
  580 STOP
      END
```

```
      SUBROUTINE CORE(KFL)                                                   CORE    2
C     ****************************************************************       CORE    3
C                                                                            CORE    4
C                        CORE PROGRAM OF                                     CORE    5
C                THE SEQUENCE ACCOUNTABLE FATIGUE ANALYSIS                   CORE    6
C                                                                            CORE    7
C                                                                            CORE    8
C                             MODULE II                                      STD     1
C                                                                            CORE   10
C                  LOCAL STRESS AND STRAIN DETERMINATION                     CORE   11
C                                                                            CORE   12
C     ****************************************************************       CORE   13
C                                                                            CORE   14
      COMMON/MDEC1/SIGMAX(200),SIGMIN(200)                                   CORE   15
      COMMON/MSAL/RNCYC(200),KPMAX,IPRINT                                    CORE   16
      DIMENSION PLSTRA(200), FN(200),AVSGMX(200),AVSGMN(200),EX(200),       CORE   17
     *ENNCYC(200),ASX(200),ASN(200),ASE(200)                                 CORE   18
      COMMON/MCOR1/NLEVEL,IRPCM,IPLOT,ELMOD,TYS,EPSO,COFMAN,C1,E2,E1,       CORE   19
     *RES(200),AKT,SUMENN,SUMNC                                              CORE   20
      COMMON/MCOR2/STMIN(200),STMAX(200),ENN(200),A(10),B(10),C(10),        CORE   21
     *R(10),ISTEP(200),NN(200,10),IBLOCK(200)                                CORE   22
      JJ=KFL                                                                 CORE   23
      IF(JJ.GT.3)IPRINT=3                                                    CORE   24
      IRAIN=1                                                                CORE   25
      WRITE(6,54)JJ                                                          CORE   26
   54 FORMAT(20H FLIGHT OR BLOCK NO.,I5)                                     CORE   27
      IF(IPRINT.GE.3) GO TO 51                                               CORE   28
      WRITE(6,62)                                                            CORE   29
   62 FORMAT(66H STMAX   STMIN   SIGMAX  SIGMIN   RES    EORES    ENN       CORE   30
     *      NEP)                                                             CORE   31
   51 CONTINUE                                                               CORE   32
C                                                                            CORE   33
C                                                                            CORE   34
      KPLOT=1                                                                CORE   35
  148 DO 570 J=1,NLEVEL                                                      CORE   36
  149 I=J+1                                                                  CORE   37
      PLSTRA(J)=0.                                                           CORE   38
C                                                                            CORE   39
C       DETERMINE SEQUENCE ACCOUNTABLE RESIDUAL STRESS AND CORRESPONDING     CORE   40
C         PLASTIC STRAIN                                                     CORE   41
C                                                                            CORE   42
  150 ASMAX=AKT*STMAX(J)                                                     CORE   43
      ASMIN=AKT*STMIN(J)                                                     CORE   44
        ASX(KPLOT)=ASMAX                                                     CORE   45
      ASN(KPLOT)=ASMIN                                                       CORE   46
      ASE(KPLOT)=ENN(J)                                                      CORE   47
      KPLOT=KPLOT+1                                                          CORE   48
      ASMEAN=(ASMAX+ASMIN)/2.                                                CORE   49
      JA=0                                                                   CORE   50
  170 IF(RES(I-1)+ASMIN+TYS) 190,190,200                                     CORE   51
  190 JA=1                                                                   CORE   52
      AAA=RES(I-1)+ASMIN                                                     CORE   53
      PLSTRA(J)=    -1.*(AAA/ELMOD)*(1.+AAA/TYS)                             CORE   54
  200 JB=0                                                                   CORE   55
  202 IF(RES(I-1)+ASMAX-TYS) 220,210,210                                     CORE   56
```

```
 210   J3=-1                                                             CORE   57
       AAA=ASMAX                                                         CORE   58
       BBB=TYS-RES(I-1)                                                  CORE   59
       IF(BBB.GE.TYS) GO TO 214                                          CORE   60
 212   BBB=0.                                                            CORE   61
 214   PLSTRA(J)=    AAA*AAA/(ELMOD*TYS)-BBB*BBB/(ELMOD*TYS)             CORE   62
 220   IF(JA+JB) 230,250,240                                             CORE   63
 230   RES(I)=TYS-ASMAX                                                  CORE   64
       GO TO 290                                                         CORE   65
 240   RES(I)=-TYS-ASMIN                                                 CORE   66
       GO TO 290                                                         CORE   67
 250   IF(JA) 260,260,270                                                CORE   68
 260   RES(I)=RES(I-1)                                                   CORE   69
       GO TO 290                                                         CORE   70
 270   RES(I)=-ASMEAN                                                    CORE   71
 290   SIGMAX(IRAIN)=RES(I)+ASMAX                                        CORE   72
       SIGMIN(IRAIN)=RES(I)+ASMIN                                        CORE   73
       RNCYC(IRAIN)=ENN(J)                                               CORE   74
       IF(ASMAX.LE.TYS) GO TO 410                                        CORE   75
 400   EQRES=-ASMAX+TYS                                                  CORE   76
       GO TO 440                                                         CORE   77
 410   IF(ASMIN.GE.-TYS) GO TO 430                                       CORE   78
 420   EQRES=-ASMIN-TYS                                                  CORE   79
       GO TO 440                                                         CORE   80
 430   EQRES=0.                                                          CORE   81
 440   DIF=RES(I)-EQRES                                                  CORE   82
C                                                                        CORE   83
C        CALCULATE RELAXATION FUNCTION                                   CORE   84
C                                                                        CORE   85
       ABMAX=ABS(ASMAX)                                                  CORE   86
       ABMIN=ABS(ASMIN)                                                  CORE   87
       ABMEAN=ABS(ASMEAN)                                                CORE   88
        IF(ABMAX.LT.1.)ABMAX=1.                                          CORE   89
        IF(ABMEAN.LT.1.)ABMEAN=0.5                                       CORE   90
       IF(ABMIN-ABMAX) 444,444,442                                       CORE   91
 442   ABM=ABMIN                                                         CORE   92
       GO TO 446                                                         CORE   93
 444   ABM=ABMAX                                                         CORE   94
 446   ENEP=C1/(ABM**E1*ABMEAN**E2)                                      CORE   95
       IF(IPRINT.GE.3)GO TO 351                                          CORE   96
       WRITE(6,350) STMAX(J),STMIN(J),SIGMAX(IRAIN),SIGMIN(IRAIN),       CORE   97
      *RES(I),EQRES,ENN(J),ENEP,J                                        CORE   98
 350    FORMAT(6(F7.2,1X),F6.2,1X,E15.8,5X,I6)                           CORE   99
 351     CONTINUE                                                        CORE  100
C                                                                        CORE  101
C        CALCULATE RESIDUAL STRESS RELAXATION                            CORE  102
C                                                                        CORE  103
       IRAIN=IRAIN+1                                                     CORE  104
       ABDIF=ABS(DIF)                                                    CORE  105
       GO TO 350                                                         CORE  106
       GO TO 550                                                         CORE  107
 360   IF(ABDIF.LT.5.) GO TO 560                                         CORE  108
 370   IF(1000.*ENN(J).LT.ENEP) GO TO 560                                CORE  109
        IF(ENN(J).LE.10.) GO TO 560                                      CORE  110
 380   NFLAG=0                                                           CORE  111
```

```
      NFLAG2=10
      IRAIN=IRAIN-1
      DUMMY=ENN(J)
  450 IF(DUMMY-ENEP) 470,460,460
  460 DUMMY=DUMMY/2.
      NFLAG=NFLAG+1
      GO TO 450
  470 CYCINT=DUMMY/10.
      DO 510 K=1,10
      DECK=FLOAT(K)
      EN(K)=CYCINT*DECK
      IF(K.EQ.1) GO TO 490
  480 EX(K)=EXP(-2.303*EN(K-1)/ENEP)+EXP(-2.303*EN(K)/ENEP)
      GO TO 500
  490 EX(K)=1.+EXP(-2.303*EN(K)/ENEP)
  500 CONTINUE
      IF(NFLAG.EQ.0) GO TO 530
  510 NFLAG2=NFLAG+10
      DO 520 K=11,NFLAG2
      EN(K)=2.*DUMMY
      EX(K)=EXP(-2.303*EN(K-1)/ENEP)+EXP(-2.303*EN(K)/ENEP)
      DUMMY=2.*DUMMY
  520 CONTINUE
  530 DO 559 K=1,NFLAG2
      AVSGMX(K)=ASMAX+EQRES+DIF*EX(K)/2.
      AVSGMN(K)=AVSGMX(K)-ASMAX+ASMIN
      SIGMIN(IRAIN)=AVSGMN(K)
      SIGMAX(IRAIN)=AVSGMX(K)
      RNCYC(IRAIN)=EN(K)
  545 IF(K.EQ.1) GO TO 543
  539 RNCYC(IRAIN)=RNCYC(IRAIN)-EN(K-1)
  540 IF(IPRINT.GE.3)GO TO 551
      WRITE(6,550) SIGMAX(IRAIN),SIGMIN(IRAIN),EN(K),RNCYC(IRAIN)
  550 FORMAT(16X,2(F7.2,1X),16X,F6.2,17X,F15.8)
  551  CONTINUE
      IRAIN=IRAIN+1
  559  CONTINUE
  560 CONTINUE
      RES(I)=EQRES+DIF*EXP(-2.303*ENN(J)/ENEP)
  570 CONTINUE
  569 RES(1)=RES(J)
      IN=IRAIN-1
C
C     ****************************************************************
C
C                          MODULE III
C                  CYCLE COUNTING TECHNIQUE
C
C     ****************************************************************
C
C        CALL SUBROUTINE TO RANGE PAIR COUNT SPECTRUM
C
       IF(IRPCM.GT.1)GO TO 591
      CALL RPCM(IN)
      GO TO 592
```

```
      591  CONTINUE                                                        CORE   167
           KPMAX=IN                                                        CORE   168
      592  CONTINUE                                                        CORE   169
     C                                                                     CORE   170
     C     *************************************************************** CORE   171
     C                                                                     CORE   172
     C                          MODULE IV                                  STD      3
     C                   DAMAGE ACCUMULATION CALCULATION                   CORE   174
     C                                                                     CORE   175
     C     *************************************************************** CORE   176
     C                                                                     CORE   177
           IF(IPRINT.GE.3)GO TO 552                                        CORE   178
           WRITE(6,53)                                                     CORE   179
       53  FORMAT(//60H LOCAL STRESSES AND PLASTIC STRAINS W/RESULTING FATIGU CORE   180
          *E LIFE//10X,4HSTEP,10X,14HPLASTIC STRAIN,10X,10HMAX OR MIN,15X,6HD CORE   181
          *AMAGE)                                                          CORE   182
      552   CONTINUE                                                       CORE   183
     C                                                                     CORE   184
     C       CALCULATE DAMAGE FROM PLASTIC STRAIN CYCLES                   CORE   185
     C                                                                     CORE   186
           SUMDEL=0.                                                       CORE   187
           DO 531 JKL=1,NLEVEL                                             CORE   188
           AA=1.                                                           CORE   189
           IF(PLSTRA(JKL)) 532,531,533                                     CORE   190
      532  AA=-1.                                                          CORE   191
      533  PLSTRA(JKL)=AA*PLSTRA(JKL)                                      CORE   192
           CYCLES=(PLSTRA(JKL)/EPSD)**COFMAN                               CORE   193
           DAM=1./CYCLES                                                   CORE   194
           SUMNC=SUMNC+DAM                                                 CORE   195
           SUMDEL=SUMDEL+DAM                                               CORE   196
           IF(IPRINT.GE.3) GO TO 531                                       CORE   197
           IF (AA) 535,535,537                                             CORE   198
      535  WRITE(6,199)JKL,PLSTRA(JKL),DAM                                 CORE   199
      199  FORMAT(10X,I4,12X,F10.5,15X,3HMIN,15X,E14.6)                    CORE   200
            GO TO 531                                                      CORE   201
      537  WRITE(6,219)JKL,PLSTRA(JKL),DAM                                 CORE   202
      219  FORMAT(10X,I4,12X,F10.5,15X,3HMAX,15X,E14.6)                    CORE   203
      531  CONTINUE                                                        CORE   204
           WRITE(6,541) SUMDEL                                             CORE   205
      541  FORMAT(59X,29H DAMAGE FROM PLASTIC STRAINS=,E15.8)              CORE   206
           IF(IPRINT.GE.3) GO TO 536                                       CORE   207
           WRITE(6,13)                                                     CORE   208
       13  FORMAT(/16X,15H SIGMAX  SIGMIN,18X,6H RNCYC,20X,25H CYCLES      CORE   209
          *   ENN/CYC)                                                     CORE   210
      536  CONTINUE                                                        CORE   211
     C                                                                     CORE   212
     C       CALCULATE ELASTIC CYCLE DAMAGE FROM LEAST SQUARE FITTED S-N DATA CORE   213
     C          (MODIFIED GOODMAN DIAGRAM FORMAT)                          CORE   214
     C                                                                     CORE   215
           DO 600 JKL=1,KPMAX                                              CORE   216
      534  TTYS=TYS/5.                                                     CORE   217
           X=SIGMIN(JKL)                                                   CORE   218
           Y=SIGMAX(JKL)                                                   CORE   219
           IF(Y-X.LT.1.6*TYS) GO TO 310                                    CORE   220
           CYCLES=10.**4.                                                  CORE   221
```

```
      GO TO 340                                                          CORE  222
  310 IF(Y.GE.TTYS) GO TO 320                                            CORE  223
  347 CYCLES=10.**9.                                                     CORE  224
       GO TO 340                                                         CORE  225
  320 N=4                                                                CORE  226
      DO 330 M=1,4                                                       CORE  227
      R(N)=A(N)*X**2+B(N)*X+C(N)-Y                                       CORE  228
      N=N+1                                                              CORE  229
  330 CONTINUE                                                           CORE  230
  332 IF(R(7)*R(4)) 339,338,334                                          CORE  231
  334 ABR7=ABS(R(7))                                                     CORE  232
      ABR4=ABS(R(4))                                                     CORE  233
      IF(ABR7.LE.ABR4 ) GO TO 335                                        CORE  234
  335 EXPO=4.+R(4)/(R(4)-R(5))                                           CORE  235
      GO TO 339                                                          CORE  236
  336 EXPO=7.+R(7)/(R(6)-R(7))                                           CORE  237
      GO TO 339                                                          CORE  238
  338 SUMR=R(4)+R(5)+R(6)+R(7)                                           CORE  239
      SUMR2=R(4)**2+R(5)**2+R(6)**2+R(7)**2                              CORE  240
      SUMR3=R(4)**3+R(5)**3+R(6)**3+R(7)**3                              CORE  241
      SUMR4=R(4)**4+R(5)**4+R(6)**4+R(7)**4                              CORE  242
      SUMRN=4.*R(4)+5.*R(5)+6.*R(6)+7.*R(7)                              CORE  243
      SUMR2N=4.*R(4)**2+5.*R(5)**2+6.*R(6)**2+7.*R(7)**2                 CORE  244
      DEL1=4.*SUMR2*SUMR4-4.*SUMR3**2                                    CORE  245
      DEL2=SUMR*SUMR2*SUMR3-SUMR4*SUMR**2                                CORE  246
      DEL3=SUMR*SUMR2*SUMR3-SUMR2**3                                     CORE  247
      D01=22.*SUMR2*SUMR4-22.*SUMR3**2                                   CORE  248
      D02=SUMR2*SUMR3*SUMRN-SUMR*SUMR4*SUMRN                             CORE  249
      D03=SUMR*SUMR3*SUMR2N-SUMR2N*SUMR2**2                              CORE  250
      EXPO=(D01+D02+D03)/(DEL1+DEL2+DEL3)                                CORE  251
  339 CYCLES=10.**EXPO                                                   CORE  252
      IF(EXPO.LE.4.)CYCLES=10.**4.                                       CORE  253
  340 ENNCYC(JKL)=RNCYC(JKL)/CYCLES                                      CORE  254
      SUMNC=SUMNC+ENNCYC(JKL)                                            CORE  255
       SUMDEL=SUMDEL+ENNCYC(JKL)                                         CORE  256
      IF(IPRINT.GE.3)GO TO 600                                           CORE  257
      WRITE(6,599) Y,X,RNCYC(JKL),CYCLES,ENNCYC(JKL)                     CORE  258
  599  FORMAT(16X,2(F7.2,1X),16X,F5.0,17X,2(E15.8,1X))                   CORE  259
  600 CONTINUE                                                           CORE  260
      WRITE(6,593)SUMDEL                                                 CORE  261
  593 FORMAT(/69X,21H DAMAGE PER THIS SET=,E15.8)                        CORE  262
      WRITE(6,575) SUMNC                                                 CORE  263
  575 FORMAT(/69X,18H  TOTAL ENN/CYC =,E15.8)                            CORE  264
      END                                                                CORE  265
```

```
      SUBROUTINE RPCM(NPKS)
C
C     THIS PROGRAM EMPLOYS THE RANGE PAIR CYCLE COUNTING METHOD TO GENER
C     ANALYSIS SPECTRUM FROM A GIVEN LOAD SPECTRUM
C
C
C                                 PROGRAM ARRAYS
C                   (INFORMATION NEEDED TO CHANGE DIMENSIONS)
C
C     ARRAY NAME              DEFINITION                       DIMENSION
C       SIGMAX      PEAKS OF THE INPUT LOAD SPECTRUM           NPKS + KK
C              KK = THE NUMBER OF ADDITIONAL CYCLES (EXCLUDING INPUT CYCL
C                   WHICH THE PROGRAM WILL GENERATE
C       SIGMIN      VALLEYS OF THE INPUT LOAD SPECTRUM         NPKS + KK
C       RNCYC       K COUNTERS OF THE PEAKS AND VALLEYS        NPKS + KK
C       NSTEP       STEP NUMBERS OF THE INPUT SPECTRUM         NPKS + KK
C       RES         RESIDUE SPECTRUM                            2*NPKS
C       INDEX       STEP NUMBERS OF ELEMENTS IN RES             2*NPKS
C       CYCLE       RANGE PAIR COUNTED CYCLES                  NPKS + KK
C       RNECYC      K COUNTERS OF THE CYCLES OF THE            NPKS + KK
C                   UNSORTED ANALYSIS SPECTRUM
C       NNSTEP      STEP NUMBERS OF ELEMENTS OF THE            NPKS + KK
C                   UNSORTED ANALYSIS SPECTRUM
C       ISAVE       VALUES OF NSTEP(J) SUCH THAT RNCYC(J)         99
C                   IS < 1.0 AND VALUES OF NSTEP(J) SUCH
C                   THAT SIGMAX(J-1) = SIGMAX(J) AND
C                   SIGMIN(J-1) = SIGMIN(J)
C
C
      COMMON/MSAL/RNCYC(200),KPMAX,IPRINT
      COMMON/MDEC1/SIGMAX(200),SIGMIN(200)
      COMMON/MDEC2/NSTEP(900),LR,KMAX,KMIN,K31
      COMMON/MDECR/RES(1400),INDEX(1400),IND1,IND2,IND3,IND4,KIND
      COMMON/MCYG/CYCLE(900,2),RNECYC(900),NNSTEP(900)
      COMMON/MCGDE/L,LIND
      DIMENSION ISAVE(99),TITLE(8)
 9999 NPUNCH = 0
      DO 8000 I = 1,NPKS
 8000 NSTEP(I) = I
      IF(IPRINT.GE.2)GO TO 103
      WRITE(6,20) NPKS
   20 FORMAT(1H0,60HTHE NUMBER OF PEAKS OR VALLEYS IN THE INPUT LOAD SPE
     1CTRUM = ,I5//)
      WRITE(6,22)
   22 FORMAT(60X,5HSIGMA/31X,4HSTEP,13X,7HMAXIMUM,16X,7HMINIMUM,13X,
     1       9HCOUNTER K/)
      WRITE(6,25) (NSTEP(I),SIGMAX(I),SIGMIN(I),RNCYC(I), I = 1,NPKS)
   25 FORMAT(29X,I5,10X,E13.6,10X,E13.6,10X,F10.5)
  103  CONTINUE
C
C     SORT THROUGH THE LOAD SPECTRUM - PULL OUT THOSE PEAKS AND VALLEYS
C     COUNTER K IS LESS THAN 1.0
C
      J = 1
      L = 0
```

```
      NRPS = 1
      RCYNO = 100
      JMAX = 0
      DO 100 I = 1,NPKS
      IF (RNCYC(I) .GE. 1.0) GO TO 100
      X1 = SIGMAX(I)
      X2 = SIGMIN(I)
      CALL CYDGEN(X1,X2 ,RNCYC(I),NSTEP(I))
      ISAVE(J) = I
      J = J + 1
  100 CONTINUE
      JMAX = J - 1
      NPKSN = NPKS - JMAX
      IF (JMAX .EQ. 0) GO TO 200
      WRITE(6,23) (ISAVE(K), K = 1,JMAX)
      IF(IPRINT.GE.2)GO TO 101
   23 FORMAT(1H0,33HSTEP NUMBERS OF THOSE PEAKS AND VALLEYS IN THE LOAD
     1SPECTRUM WHOSE COUNTER K IS LESS THAN 1.0//(17I7))
  101 CONTINUE
      DO 110 J = 1,JMAX
      I = ISAVE(J) - (J-1)
      NPKN = NPKS - J
      IF (I .EQ. NPKN) GO TO 110
      DO 115 II = I,NPKN
      SIGMAX(II) = SIGMAX(II+1)
      SIGMIN(II) = SIGMIN(II+1)
      NSTEP(II) = NSTEP(II+1)
      RNCYC(II) = RNCYC(II+1)
  115 CONTINUE
  110 CONTINUE
  200 CONTINUE
C
C     SORT THROUGH THE LOAD SPECTRUM DATA - COMBINE STEPS WITH IDENTICAL
C     AND VALLEYS WHICH OCCUR CONSECUTIVELY
C
      J = 1
      DO 300 I = 2,NPKSN
      IF (SIGMAX(I) .NE. SIGMAX(I-1)) GO TO 300
      IF (SIGMIN(I) .NE. SIGMIN(I-1)) GO TO 300
      ISAVE(J) = I
      RNCYC(I-1) = RNCYC(I-1) + RNCYC(I)
      J = J + 1
  300 CONTINUE
      IF (J .EQ. 1) GO TO 6000
      JMAS = J - 1
      DO 311 J = 1,JMAS
      I = ISAVE(J) - (J-1)
      NPKN = NPKSN - J
      IF (I .EQ. NPKN) GO TO 311
      DO 316 II = I,NPKN
      SIGMAX(II) = SIGMAX(II+1)
      SIGMIN(II) = SIGMIN(II+1)
      NSTEP(II) = NSTEP(II+1)
      RNCYC(II) = RNCYC(II+1)
  316 CONTINUE
```

```
  311 CONTINUE                                              CORE
      NPKSN = NPKSN - JMAS                                  CORE
C                                                           CORE
C     RANGE PAIR COUNT THE ADJUSTED LOAD SPECTRUM           CORE
C                                                           CORE
 6000 I = 1                                                 CORE
      KB = 0                                                CORE
      L = JMAX                                              CORE
      KMIN = 0                                              CORE
      KMAX = 0                                              CORE
      LR = 0                                                CORE
      K31 = 0                                               CORE
    1 IF (RNCYC(I) .GT. 1.0) GO TO 400                      CORE
      IF (KB .NE. 0) GO TO 5                                CORE
      X1 = SIGMAX(I)                                        CORE
      X2 = SIGMIN(I)                                        CORE
      IND1 = NSTEP(I)                                       CORE
      IND2 = IND1                                           CORE
      I = I + 1                                             CORE
      KB = 1                                                CORE
      GO TO 1                                               CORE
    5 X3 = SIGMAX(I)                                        CORE
      X4 = SIGMIN(I)                                        CORE
      IND3 = NSTEP(I)                                       CORE
      IND4 = IND3                                           CORE
      KMIN = 1                                              CORE
      KMAX = 0                                              CORE
      K31 = 0                                               CORE
      IF (RNCYC(I) .EQ. 1.0) GO TO 6                        CORE
      KEY = 1                                               CORE
      KIND = 1                                              CORE
      GO TO 415                                             CORE
    6 KEY = 0                                               CORE
      CYCNO = AINT(RNCYC(I)+0.5)                            CORE
      CALL DECIDE(X1,X2,X3,X4,KEY,I,CYCNO,KCYGEN)           CORE
 1000 GO TO (10,10,30),KCYGEN                               CORE
   10 KB = 1                                                CORE
      I = I + 1                                             CORE
      IF (KMIN .NE. 1) GO TO 36                             CORE
      IF (I .LE. NPKSN) GO TO 5                             CORE
      RES(LR+1) = X1                                        CORE
      RES(LR+2) = X2                                        CORE
      INDEX(LR+1) = IND1                                    CORE
      INDEX(LR+2) = IND2                                    CORE
      LRMAX = LR + 2                                        CORE
      GO TO 2000                                            CORE
   30 IF (KMIN .NE. 1) GO TO 35                             CORE
   12 I = I + 1                                             CORE
      IF (I .LE. NPKSN) GO TO 31                            CORE
      RES(LR+1) = X1                                        CORE
      RES(LR+2) = X2                                        CORE
      RES(LR+3) = X3                                        CORE
      INDEX(LR+1) = IND1                                    CORE
      INDEX(LR+2) = IND2                                    CORE
      INDEX(LR+3) = IND3                                    CORE
```

```
      LRMAX = LR + 3                                     CORE    431
      GO TO 2000                                         CORE    432
   31 X4 = SIGMAX(I)                                     CORE    433
      IND4 = NSTEP(I)                                    CORE    434
      KMAX = 1                                           CORE    435
      KMIN = 0                                           CORE    436
      K31 = 1                                            CORE    437
   32 IF (RNCYC(I) .GT. 1.0) GO TO 40                    CORE    438
      GO TO 5                                            CORE    439
   40 KEY = 1                                            CORE    440
      KIND = 0                                           CORE    441
      GO TO 415                                          CORE    442
   35 X4 = SIGMIN(I)                                     CORE    443
      IND4 = NSTEP(I)                                    CORE    444
      KMIN = 1                                           CORE    445
      KMAX = 0                                           CORE    446
      K31 = 0                                            CORE    447
      GO TO 32                                           CORE    448
   36 X3 = SIGMIN(I)                                     CORE    449
      IND3 = NSTEP(I)                                    CORE    450
      KMIN = 1                                           CORE    451
      KMAX = 0                                           CORE    452
      GO TO 12                                           CORE    453
  400 KEY = 1                                            CORE    454
      IF (K3 .NE. 0) GO TO 410                           CORE    455
      X1 = SIGMAX(I)                                     CORE    455
      X2 = SIGMIN(I)                                     CORE    457
      X3 = SIGMAX(I)                                     CORE    458
      X4 = SIGMIN(I)                                     CORE    459
      IND1 = NSTEP(I)                                    CORE    460
      IND2 = IND1                                        CORE    461
      IND3 = IND1                                        CORE    462
      IND4 = IND1                                        CORE    463
      KMIN = 1                                           CORE    464
      KMAX = 0                                           CORE    465
      K31 = 0                                            CORE    466
      IF (RNCYC(I) .LE. 2.0) GO TO 401                   CORE    467
      RNCYC(I) = RNCYC(I) - 1.0                          CORE    468
      GO TO 402                                          CORE    469
  401 RNCYC(I) = RNCYC(I) - 2.0                          CORE    470
  402 KIND = 0                                           CORE    471
      GO TO 415                                          CORE    472
  410 X3 = SIGMAX(I)                                     CORE    473
      X4 = SIGMIN(I)                                     CORE    474
      IND3 = NSTEP(I)                                    CORE    475
      IND4 = IND3                                        CORE    476
      KMIN = 1                                           CORE    477
      KMAX = 0                                           CORE    478
      K31 = 0                                            CORE    479
      KIND = 1                                           CORE    480
      RNCYC(I) = RNCYC(I) - 1.0                          CORE    481
      K3 = 0                                             CORE    482
  415  CYCNO = AINT(RNCYC(I)+0.5)                        CORE    483
      CALL DECIDE(X1,X2,X3,X4,KEY,I,CYCNO,KCYGEN)        CORE    484
      GO TO 1000                                         CORE    485
```

```
      2000 LMAX = L                                                       CORE   486
           IF (LRMAX .LT. 4) GO TO 5000                                   CORE   487
           IF (NCYNO .EQ. 0) GO TO 5000                                   CORE   488
C                                                                         CORE   489
C          RANGE PAIR COUNT OF RESIDUE SPECTRUMS                          CORE   490
C                                                                         CORE   491
           NRES = NRES + 1                                                CORE   492
           CALL DECRES(LRMAX,NCYNO)                                       CORE   493
           GO TO 2000                                                     CORE   494
      5000 IF (LRMAX .LE. 1) GO TO 3000                                   CORE   495
C                                                                         CORE   496
C          COUNT THE LAST RESIDUE SPECTRUM - RANGE PAIR COUNTING WILL YIELD N CORE 497
C          ADDITIONAL CYCLES                                              CORE   498
C                                                                         CORE   499
           KK = 0                                                         CORE   500
           RESMAX = RES(1)                                                CORE   501
           RESMIN = RES(1)                                                CORE   502
           IMAX = 1                                                       CORE   503
           IMIN = 1                                                       CORE   504
           DO 500 I = 2,LRMAX                                             CORE   505
           IF (RES(I) .LT. RESMAX) GO TO 490                              CORE   506
           RESMAX = RES(I)                                                CORE   507
           IMAX = I                                                       CORE   508
           GO TO 500                                                      CORE   509
       490 IF (RES(I) .GT. RESMIN) GO TO 500                              CORE   510
           RESMIN = RES(I)                                                CORE   511
           IMIN = I                                                       CORE   512
       500 CONTINUE                                                       CORE   513
           CALL CYCRES(RESMAX,RESMIN,1.0,INDEX(IMAX))                     CORE   514
           KK = KK + 1                                                    CORE   515
       510 J = IMAX - 2                                                   CORE   516
           IF (J .LE. 0) GO TO 550                                        CORE   517
           CALL CYCRES(RES(J),RES(J+1),1.0,INDEX(J))                      CORE   518
           KK = KK + 1                                                    CORE   519
           IMAX = J                                                       CORE   520
           GO TO 510                                                      CORE   521
       550 J = IMIN + 2                                                   CORE   522
           IF (J .GT. LRMAX) GO TO 575                                    CORE   523
           CALL CYCRES(RES(J-1),RES(J),1.0,INDEX(J-1))                    CORE   524
           KK = KK + 1                                                    CORE   525
           IMIN = J                                                       CORE   526
           GO TO 550                                                      CORE   527
       575 KMAX = KK                                                      CORE   528
           LMAX = L                                                       CORE   529
C                                                                         CORE   530
C          SORT THE ANALYSIS SPECTRUM TO PRODUCE THE RANGE PAIR COUNTED SPECT CORE 531
C                                                                         CORE   532
      3000 KP = 0                                                         CORE   533
           DO 605 JJ = 1,NPKS                                             CORE   534
           KC = 0                                                         CORE   535
           DO 600 I = 1,LMAX                                              CORE   536
           IF (NNSTEP(I) .NE. JJ) GO TO 600                               CORE   537
           KP = KP + 1                                                    CORE   538
           KC = KC + 1                                                    CORE   539
           NSTEP(KP) = KP                                                 CORE   540
```

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      SUBROUTINE DECIS(X1,X2,X3,X4,KEY,I,CYCNO,KCYGEN)                     CORE     581
      COMMON/MDEC1/SIGMAX(200),SIGMIN(200)                                 CORE     582
      COMMON/MDEC2/NSTEP(900),LR,KMAX,KMIN,K31                             CORE     583
      COMMON/MDECR/RES(1400),INDEX(1400),IND1,IND2,IND3,IND4,KIND          CORE     584
      COMMON/MCYG/CYCLE(900,2),RNEGCYC(900),NNSTEP(900)                    CORE     585
      COMMON/MCGDE/L,LIND                                                  CORE     586
C                                                                          CORE     587
C     THIS SUBROUTINE DECIDES WHETHER OR NOT THE VALUES X1,X2,X3, AND X4   CORE     588
C     FROM THE ADJUSTED LOAD SPECTRUM SATISFY THE RANGE PAIR COUNTING CO   CORE     589
C                                                                          CORE     590
      KFIRST = 0                                                           CORE     591
      IF (K31 .NE. 0) GO TO 11                                             CORE     592
   10 IF (X3 .LE. X2) GO TO 200                                            CORE     593
   11 IF (X2 .GT. X1) GO TO 210                                            CORE     594
      IF (X2 .LT. X4 .OR. X3 .GT. X1) GO TO 500                            CORE     595
  150 IF (X2 .GT. X3) GO TO 151                                            CORE     596
      CALL CYCGEN(X3,X2,1.0,NSTEP(I))                                      CORE     597
      GO TO 152                                                            CORE     598
  151 CALL CYCGEN(X2,X3,  1.0,NSTEP(I))                                    CORE     599
  152 X1 = X1                                                              CORE     600
      X2 = X4                                                              CORE     601
      IF (IND3 .NE. IND2) LIND = 1                                         CORE     602
      IND2 = IND4                                                          CORE     603
      KCYGEN = 1                                                           CORE     604
      IF (KEY .NE. 0) GO TO 110                                            CORE     605
      RETURN                                                               CORE     606
  210 IF (X2 .GT. X4 .OR. X3 .LT. X1) GO TO 500                            CORE     607
      GO TO 150                                                            CORE     608
  200 X1 = X1                                                              CORE     609
      X2 = X4                                                              CORE     610
      IND2 = IND4                                                          CORE     611
      KCYGEN = 2                                                           CORE     612
      IF (KEY .EQ. 0) RETURN                                               CORE     613
      CYCNO = CYCNO - 1.0                                                  CORE     614
      GO TO 110                                                            CORE     615
C                                                                          CORE     616
C     ADD X1 TO THE RESIDUE SPECTRUM                                       CORE     617
C                                                                          CORE     618
  500 LR = LR + 1                                                          CORE     619
      RES(LR) = X1                                                         CORE     620
      INDEX(LR) = IND1                                                     CORE     621
      X1 = X2                                                              CORE     622
      X2 = X3                                                              CORE     623
      X3 = X4                                                              CORE     624
      IND1 = IND2                                                          CORE     625
      IND2 = IND3                                                          CORE     626
      IND3 = IND4                                                          CORE     627
      KCYGEN = 3                                                           CORE     628
      IF (KEY .NE. 0) GO TO 110                                            CORE     629
      RETURN                                                               CORE     630
  110 GO TO (1150,1200,1500),KCYGEN                                        CORE     631
 1150 IF (CYCNO .GT. 1.0) GO TO 1151                                       CORE     632
      IF (CYCNO .EQ. 0.0) RETURN                                           CORE     633
 1153 CYCNO = CYCNO - 1.0                                                  CORE     634
      GO TO 1152                                                           CORE     635
```

```
 1151 IF (LIND .EQ. 1) GO TO 1153                             CORE   636
      IF (IND3 .NE. IND4) GO TO 1153                          CORE   637
      RNECYC(L) = RNECYC(L) + CYCNO - 2.0                     CORE   638
      CYCNO = 1.0                                             CORE   639
 1152 IF (KMAX .NE. 1) GO TO 111                              CORE   640
      X3 = SIGMIN(I)                                          CORE   641
      IND3 = NSTEP(I)                                         CORE   642
      IF (CYCNO .NE. 0.0) GO TO 112                           CORE   643
      KMIN = 1                                                CORE   644
      KMAX = 0                                                CORE   645
      KCYGEN = 3                                              CORE   646
      RETURN                                                  CORE   647
 1200 IF (CYCNO .EQ. 0.0) RETURN                              CORE   648
      CYCNO = CYCNO - 1.0                                     CORE   649
      X3 = SIGMAX(I)                                          CORE   650
      X4 = SIGMIN(I)                                          CORE   651
      KFIRST = 1                                              CORE   652
      GO TO 113                                               CORE   653
  111 X3 = SIGMAX(I)                                          CORE   654
      X4 = SIGMIN(I)                                          CORE   655
      IF (KFIRST .NE. 0) GO TO 113                            CORE   656
      CYCNO = CYCNO - 1.0                                     CORE   657
      KFIRST = 1                                              CORE   658
  113 IND3 = NSTEP(I)                                         CORE   659
      IND4 = IND3                                             CORE   660
      KMIN = 1                                                CORE   661
      KMAX = 0                                                CORE   662
      GO TO 11                                                CORE   663
 1500 IF (KMAX .NE. 0) GO TO 1510                             CORE   664
      IF (CYCNO .EQ. 0.0) RETURN                              CORE   665
      CYCNO = CYCNO - 1.0                                     CORE   666
  112 X4 = SIGMAX (I)                                         CORE   667
      IND4 = NSTEP(I)                                         CORE   668
      KMAX = 1                                                CORE   669
      KMIN = 0                                                CORE   670
      GO TO 11                                                CORE   671
 1510 X4 = SIGMIN(I)                                          CORE   672
      IND4 = NSTEP(I)                                         CORE   673
      KMAX = 0                                                CORE   674
      KMIN = 1                                                CORE   675
      GO TO 10                                                CORE   676
      END                                                     CORE   677
```

```
      SUBROUTINE DECRES(LRMAX,NOYND)                                    CORE     678
      COMMON/MCGDE/L,LIND                                               CORE     679
      COMMON/MDECR/RES(1400),INDEX(1400),IND1,IND2,IND3,IND4,KIND       CORE     680
C                                                                       CORE     681
C     THIS SUBROUTINE DECIDES WHETHER OR NOT THE ELEMENTS OF THE RESIDUE CORE    682
C     SPECTRUM SATISFY THE RANGE PAIR COUNTING CONDITIONS               CORE     683
C                                                                       CORE     684
      K = 0                                                             CORE     685
      NOYND = 0                                                         CORE     686
      X1 = RES(1)                                                       CORE     687
      X2 = RES(2)                                                       CORE     688
      X3 = RES(3)                                                       CORE     689
      X4 = RES(4)                                                       CORE     690
      IND1 = INDEX(1)                                                   CORE     691
      IND2 = INDEX(2)                                                   CORE     692
      IND3 = INDEX(3)                                                   CORE     693
      IND4 = INDEX(4)                                                   CORE     694
      J = 4                                                             CORE     695
   10 IF (X2 .GT. X1) GO TO 100                                         CORE     696
      IF (X2 .LT. X4 .OR. X3 .GT. X1) GO TO 500                         CORE     697
  150 IF (X2 .GT. X3) GO TO 151                                         CORE     698
      CALL CYCRES(X3,X2,1.0,IND3)                                       CORE     699
      GO TO 152                                                         CORE     700
  151 CALL CYCRES(X2,X3,1.0,IND2)                                       CORE     701
  152 NOYND = NOYND + 1                                                 CORE     702
      X1 = X1                                                           CORE     703
      X2 = X4                                                           CORE     704
      IND2 = IND4                                                       CORE     705
      IF (J .EQ. LRMAX) GO TO 300                                       CORE     706
      IF ((J + 1) .EQ. LRMAX) GO TO 315                                 CORE     707
      X3 = RES(J+1)                                                     CORE     708
      X4 = RES(J+2)                                                     CORE     709
      IND3 = INDEX(J+1)                                                 CORE     710
      IND4 = INDEX(J+2)                                                 CORE     711
      J = J+2                                                           CORE     712
      GO TO 10                                                          CORE     713
  100 IF (X2 .GT. X4 .OR. X3 .LT. X1) GO TO 500                         CORE     714
      GO TO 150                                                         CORE     715
  500 K = K + 1                                                         CORE     716
      RES(K) = X1                                                       CORE     717
      INDEX(K) = IND1                                                   CORE     718
      J = J + 1                                                         CORE     719
      IF (J .GT. LRMAX) GO TO 330                                       CORE     720
      X1 = X2                                                           CORE     721
      X2 = X3                                                           CORE     722
      X3 = X4                                                           CORE     723
      X4 = RES(J)                                                       CORE     724
      IND1 = IND2                                                       CORE     725
      IND2 = IND3                                                       CORE     726
      IND3 = IND4                                                       CORE     727
      IND4 = INDEX(J)                                                   CORE     728
      GO TO 10                                                          CORE     729
  300 K = K + 1                                                         CORE     730
      RES(K) = X1                                                       CORE     731
      RES(K+1) = X2                                                     CORE     732
```

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      INDEX(K) = IND1                                   CORE   733
      INDEX(K+1) = IND2                                 CORE   734
      LRMAX = K + 1                                     CORE   735
      RETURN                                            CORE   736
  315 K = K + 1                                         CORE   737
      RES(K) = X1                                       CORE   738
      RES(K+1) = X2                                     CORE   739
      RES(K+2) = RES(J+1)                               CORE   740
      INDEX(K) = IND1                                   CORE   741
      INDEX(K+1) = IND2                                 CORE   742
      INDEX(K+2) = INDEX(J+1)                           CORE   743
      LRMAX = K + 2                                     CORE   744
      RETURN                                            CORE   745
  330 K = K + 1                                         CORE   746
      RES(K) = X2                                       CORE   747
      RES(K+1) = X3                                     CORE   748
      RES(K+2) = X4                                     CORE   749
      INDEX(K) = IND2                                   CORE   750
      INDEX(K+1) = IND3                                 CORE   751
      INDEX(K+2) = IND4                                 CORE   752
      LRMAX = K + 2                                     CORE   753
      RETURN                                            CORE   754
      END                                               CORE   755
```

```
      SUBROUTINE CYCRES(Y1,Y2,  CYCPF,NSTEPP)                           CORE   756
      COMMON/MCYG/CYCLE(900,2),RNECYC(900),NNSTEP(900)                   CORE   757
      COMMON/MCGDE/L,LINO                                                CORE   758
C                                                                        CORE   759
C     THIS SUBROUTINE GENERATES CYCLES FOR THE ANALYSIS SPECTRUM FROM DA CORE   760
C     SUPPLIED BY SUBROUTINE DECRES                                      CORE   761
C                                                                        CORE   762
      L = L + 1                                                          CORE   763
      CYCLE(L,1) = Y1                                                    CORE   764
      CYCLE(L,2) = Y2                                                    CORE   765
      RNECYC(L) = CYCPF                                                  CORE   766
      NNSTEP(L) = NSTEPP                                                 CORE   767
      RETURN                                                             CORE   768
      END                                                                CORE   769
```

APPENDIX II

SAMPLE PROBLEM WITH INPUT DATA LISTING

```
1 DATA DECKS ARE TO EE PROCESSED.

SPECTRUM SUBJECTED TO THE RANGE-PAIR COUNTING TECHNIQUE
SEQUENCE ACCOUNTABLE FATIGUE EVALUATION
```

SPECTRUM FROM B-1 SPECTRUM -- TRUNCATION LEVEL 270,000 CYCLES
MATERIAL TYPE -- 2219-T851 AL

TENSILE YIELD STRESS (KSI) -- 55.00000

LCF STRAIN INTERCEPT = .40000

INVERSE OF COFFIN-MANSON SLOPE -1.83500

ELASTIC MODULUS = 10000.00000

COEFFICIENTS OF SECOND ORDER LEAST SQUARE FIT OF S-N DATA
SMAX = A(I)*SMIN**2 + B(I)*SMIN + C(I)

LIFE	A(I)	B(I)	C(I)
10** 4	-.00217	.22041	55.82462
10** 5	-.00178	.33210	48.26657
10** 6	-.00149	.46283	39.66455
10** 7	-.00243	.64199	31.70955

UNNOTCHED COUPON S-N DATA DERIVED FROM
INFORMATION SUPPLIED FROM NORTH AMERICAN

RESIDUAL STRESS RELAXATION FUNCTION

ENEP = C1/(KTSMAX**E1 * KTSMEAN**E2)
WHERE C1 = .25000000E+07 , E1 = 1.000 AND E2 = 1.000

7 TIMES THROUGH BLOCK OF 44 LOADS

LOAD LIMIT = 26.90000

STEP	TYPE	STMIN	STMAX	ENN
1	1	-.14800	-.02900	1.00000
2	3	.58400	1.00000	1.00000
3	2	.58400	.89500	1.00000
4	1	.58400	.68400	1.00000
5	1	.45500	.58400	1.00000
6	1	.64800	.69300	1.00000
7	1	.39500	.69900	1.00000
8	1	.48800	.56300	3.00000
9	1	.23500	.50900	1.00000
10	1	.50900	.62700	2.00000
11	1	.43400	.50900	1.00000
12	1	.36400	.69000	1.00000
13	1	.13300	.36400	1.00000
14	1	.36400	.48200	6.00000
15	1	.30400	.36400	1.00000
16	1	.30700	.75600	1.00000
17	1	.31600	.52700	1.00000
18	2	.54500	.70800	1.00000
19	1	.33400	.61700	1.00000
20	1	.40100	.51200	7.00000
21	1	.12700	.54800	1.00000
22	1	.22900	.37700	48.00000
23	1	-.00600	.34000	1.00000
24	1	.13000	.24400	35.00000
25	1	.07800	.72300	1.00000
26	1	.11100	.55700	9.00000
27	1	.18700	.37700	10.00000
28	3	.52700	.99100	1.00000
29	2	-.12000	.88300	1.00000

3[illegible]	1	.527[illegible]	.747[illegible]	1.[illegible]
31	1	-.14800	-.02900	1.00000
32	1	.55700	.84600	1.00000
33	1	.50900	.88000	1.00000
34	1	.33100	.52700	1.00000
35	1	.52700	.61700	19.00000
36	1	.46400	.52700	2.00000
37	1	.48200	.81000	1.00000
38	1	.58100	.68700	1.00000
39	1	.32200	.70200	1.00000
40	1	.39500	.44900	9.00000
41	1	.43100	.59000	5.00000
42	1	.46100	.54500	29.00000
43	1	-.14800	-.02900	1.00000
44	1	-.13600	-.13900	1.00000

BLOCK	TYPE	TYPE	TYPE	TYPE	TYPE	TYPE	TYPE	TYPE
1	1	-0	-0					
2	1	-0	-0					
3	2	1	-0					
4	1	-0	-0					
5	3	1	-0					
6	1	-0	-0					
7	1	-0	-0					

SPECTRUM FROM B-1 SPECTRUM -- TRUNCATION LEVEL 270,000 CYCLES

AKT = 4.90

RELAXATION CONSTANT CTA 2500000.00

SPECTRUM SUBJECTED TO THE RANGE-PAIR COUNTING TECHNIQUE
FLIGHT OR BLOCK NO. 1

STMAX	STMIN	SIGMAX	SIGMIN	RES	EQRES	ENN	NEP	
-.78	-3.98	-3.51	-17.92	0.00	0.00	1.00	.13025831E+05	1
18.40	15.71	55.00	42.89	-27.80	-27.80	1.00	.39342782E+03	2
15.71	12.24	42.89	27.20	-27.80	-15.69	1.00	.56235689E+03	3
18.64	17.43	55.00	49.55	-28.89	-28.89	1.00	.36717948E+03	4
18.80	10.63	55.00	18.20	-29.61	-29.61	1.00	.44621680E+03	5
15.14	13.13	38.54	29.46	-29.61	-13.15	3.00	.57667259E+03	6
13.69	6.32	32.20	-.97	-29.42	-6.61	1.00	.90105168E+03	7
16.37	13.69	46.54	32.25	-29.36	-20.90	2.00	.47906511E+03	8
13.69	11.67	32.34	23.26	-29.28	-6.61	1.00	.71090397E+03	9
18.56	9.79	54.32	14.86	-29.21	-28.52	1.00	.46919213E+03	10
9.79	3.58	14.86	-13.10	-29.20	0.00	1.00	.18861779E+04	11
12.97	9.79	29.18	14.90	-29.17	-3.35	6.00	.83680259E+03	12
9.79	8.18	15.32	8.06	-28.74	0.00	1.00	.14033389E+04	13
20.34	8.26	55.00	.65	-36.51	-36.51	1.00	.42460525E+03	14
14.18	8.50	27.28	1.74	-36.51	-8.79	1.00	.76807252E+03	15
16.60	8.98	38.26	4.00	-36.43	-19.69	1.00	.58153350E+03	16
13.77	10.79	25.61	12.18	-36.35	-6.98	7.00	.72996103E+03	17
14.74	3.42	30.61	-20.35	-35.72	-11.34	1.00	.92247814E+03	18
10.14	6.16	9.97	-7.94	-35.66	0.00	48.00	.14935730E+04	19
		10.11	-7.81			4.80		4.80000000
		10.37	-7.55			9.60		4.80000000
		10.63	-7.29			14.40		4.80000000
		10.89	-7.03			19.20		4.80000000
		11.14	-6.77			24.00		4.80000000
		11.40	-6.52			28.80		4.80000000
		11.65	-6.27			33.60		4.80000000
		11.90	-6.02			38.40		4.80000000
		12.15	-5.77			43.20		4.80000000
		12.40	-5.52			48.00		4.80000000
9.15	-.16	8.04	-33.84	-33.12	0.00	1.00	.30047963E+04	20
6.56	3.50	-3.56	-17.36	-33.09	0.00	35.00	.37392025E+04	21
		-3.52	-17.32			3.50		3.50000000
		-3.45	-17.25			7.00		3.50000000
		-3.38	-17.18			10.50		3.50000000
		-3.31	-17.11			14.00		3.50000000
		-3.24	-17.04			17.50		3.50000000
		-3.17	-16.97			21.00		3.50000000
		-3.10	-16.90			24.50		3.50000000
		-3.03	-16.83			28.00		3.50000000
		-2.96	-16.76			31.50		3.50000000
		-2.89	-16.69			35.00		3.50000000
19.45	2.10	55.00	-23.08	-32.52	-32.52	1.00	.58920931E+03	22
14.98	2.99	34.91	-19.08	-32.52	-12.42	9.00	.91708325E+03	23
10.14	5.03	13.57	-9.43	-32.07	0.00	10.00	.16047965E+04	24
20.09	14.18	55.00	28.37	-35.42	-35.42	1.00	.35855054E+03	25
-.78	-3.98	-38.93	-53.34	-35.42	0.00	1.00	.13025831E+05	26
22.76	14.98	55.00	25.02	-47.41	-47.41	1.00	.28748314E+03	27
23.67	13.69	55.00	10.09	-51.52	-51.52	1.00	.27916148E+03	28
14.18	8.90	12.27	-11.46	-51.52	-8.79	1.00	.75464468E+03	29
16.60	14.18	23.29	12.40	-51.39	-19.69	19.00	.48342514E+03	30
		23.44	12.54			1.90		1.90000000
		23.72	12.83			3.80		1.90000000
		24.00	13.11			5.70		1.90000000

		24.28	13.39			7.60		1.90000000
		24.56	13.66			9.50		1.90000000
		24.83	13.94			11.40		1.90000000
		25.11	14.21			13.30		1.90000000
		25.37	14.48			15.20		1.90000000
		25.64	14.75			17.10		1.90000000
		25.91	15.01			19.00		1.90000000
14.18	12.48	15.14	7.52	-48.65	-8.79	2.00	.65336542E+03	31
21.79	12.97	49.68	9.98	-48.37	-43.05	1.00	.32605652E+03	32
18.48	15.63	34.83	22.00	-48.33	-28.16	1.00	.39170979E+03	33
18.88	8.66	36.76	-9.24	-48.21	-29.98	1.00	.47468264E+03	34
12.08	10.63	6.23	-.31	-48.13	0.00	9.00	.90043347E+03	35
15.87	11.59	24.39	5.14	-47.03	-16.42	5.00	.56645141E+03	36
14.66	12.40	19.56	9.39	-46.41	-10.97	29.00	.62236611E+03	37
		19.75	9.58			2.90		2.90000000
		20.12	9.95			5.80		2.90000000
		20.50	10.33			8.70		2.90000000
		20.86	10.70			11.60		2.90000000
		21.23	11.06			14.50		2.90000000
		21.59	11.42			17.40		2.90000000
		21.94	11.78			20.30		2.90000000
		22.30	12.13			23.20		2.90000000
		22.65	12.48			26.10		2.90000000
		22.99	12.82			29.00		2.90000000
-.78	-3.98	-40.60	-55.00	-37.08	0.00	1.00	.13025831E+05	38
-1.05	-3.66	-41.80	-53.54	-37.08	0.00	1.00	.14337171E+05	39

THE NUMBER OF PEAKS OR VALLEYS IN THE INPUT LOAD SPECTRUM = 75

41

STEP	SIGMA MAXIMUM	SIGMA MINIMUM	COUNTER K
1	-.351045E+01	-.179154E+02	1.00000
2	.550000E+02	.428950E+02	1.00000
3	.428950E+02	.272795E+02	1.00000
4	.550000E+02	.495527E+02	1.00000
5	.550000E+02	.182008E+02	1.00000
6	.385372E+02	.294585E+02	3.00000
7	.321966E+02	-.971139E+00	1.00000
8	.465387E+02	.322548E+02	2.00000
9	.323357E+02	.232570E+02	1.00000
10	.543191E+02	.148568E+02	1.00000
11	.148601E+02	-.131024E+02	1.00000
12	.291797E+02	.148958E+02	6.00000
13	.153186E+02	.805562E+01	1.00000
14	.550000E+02	.648550E+00	1.00000
15	.272796E+02	.173800E+01	1.00000
16	.382570E+02	.399989E+01	1.00000
17	.256130E+02	.121764E+02	7.00000
18	.306127E+02	-.203494E+02	1.00000
19	.101054E+02	-.781000E+01	4.80000
20	.103674E+02	-.754800E+01	4.80000
21	.106275E+02	-.728793E+01	4.80000
22	.108856E+02	-.702978E+01	4.80000
23	.111419E+02	-.677353E+01	4.80000
24	.113962E+02	-.651917E+01	4.80000
25	.116487E+02	-.626669E+01	4.80000
26	.118993E+02	-.601607E+01	4.80000
27	.121481E+02	-.576729E+01	4.80000
28	.123950E+02	-.552036E+01	4.80000
29	.803921E+01	-.338441E+02	1.00000
30	-.352359E+01	-.173203E+02	3.50000
31	-.344941E+01	-.172491E+02	3.50000
32	-.337838E+01	-.171781E+02	3.50000
33	[illegible]	[illegible]	

34	-.323678E+01	-.170365E+02	3.50000
35	-.316621E+01	-.169659E+02	3.50000
36	-.309579E+01	-.168955E+02	3.50000
37	-.302552E+01	-.168252E+02	3.50000
38	-.295540E+01	-.167551E+02	3.50000
39	-.288544E+01	-.166851E+02	3.50000
40	.550000E+02	-.230772E+02	1.00000
41	.349357E+02	-.190826E+02	9.00000
42	.135658E+02	-.943374E+01	10.00000
43	.550000E+02	.283690E+02	1.00000
44	-.389348E+02	-.533397E+02	1.00000
45	.550000E+02	.200165E+02	1.00000
46	.550000E+02	.100905E+02	1.00000
47	.122694E+02	-.114564E+02	1.00000
48	.234369E+02	.125424E+02	1.90000
49	.237213E+02	.128268E+02	1.90000
50	.240031E+02	.131086E+02	1.90000
51	.242824E+02	.133879E+02	1.90000
52	.245592E+02	.136647E+02	1.90000
53	.248335E+02	.139390E+02	1.90000
54	.251053E+02	.142108E+02	1.90000
55	.253747E+02	.144802E+02	1.90000
56	.256416E+02	.147471E+02	1.90000
57	.259062E+02	.150117E+02	1.90000
58	.151434E+02	.751720E+01	2.00000
59	.496805E+02	.997609E+01	1.00000
60	.348288E+02	.219975E+02	1.00000
61	.367628E+02	-.923622E+01	1.00000
62	.622539E+01	-.311306E+00	9.00000
63	.243886E+02	.514165E+01	5.00000
64	.197465E+02	.957830E+01	2.90000
65	.201228E+02	.995459E+01	2.90000
66	.204951E+02	.103269E+02	2.90000
67	.208634E+02	.106952E+02	2.90000
68	.212277E+02	.110595E+02	2.90000
69	.215882E+02	.114200E+02	2.90000
70	.219448E+02	.117766E+02	2.90000
71	.222977E+02	.121295E+02	2.90000
72	.226467E+02	.124785E+02	2.90000
73	.229920E+02	.128238E+02	2.90000
74	-.405950E+02	-.550000E+02	1.00000
75	-.417990E+02	-.535408E+02	1.00000

RANGE PAIR CYCLE COUNTED SPECTRUM

STEP	SIGMA MAXIMUM	SIGMA MINIMUM	COUNTER K
1	-.351045E+01	-.179154E+02	1.00000
2	.550000E+02	.272795E+02	1.00000
3	.550000E+02	.495527E+02	1.00000
4	.550000E+02	-.550000E+02	1.00000
5	.321966E+02	.294585E+02	1.00000
6	.465387E+02	.322548E+02	1.00000
7	.465387E+02	.232570E+02	1.00000
8	.323357E+02	.322548E+02	1.00000
9	.543191E+02	-.971139E+00	1.00000
10	.148601E+02	.148568E+02	1.00000
11	.291797E+02	.148958E+02	5.00000
12	.291797E+02	.805562E+01	1.00000
13	.153186E+02	.148958E+02	1.00000
14	.550000E+02	-.131024E+02	1.00000
15	.272796E+02	.173800E+01	1.00000
16	.382570E+02	.648550E+00	1.00000
17	.306127E+02	.121764E+02	1.00000
18	.101054E+02	-.781000E+01	5.00000
19	.103674E+02	-.754800E+01	5.00000
20	.106275E+02	-.728793E+01	5.00000
21	.108856E+02	-.702978E+01	5.00000
22	.111419E+02	-.677353E+01	5.00000
23	.113962E+02	-.651917E+01	5.00000
24	.116487E+02	-.626669E+01	5.00000
25	.118993E+02	-.601607E+01	5.00000
26	.121481E+02	-.576729E+01	5.00000
27	.123950E+02	-.552036E+01	4.00000
28	.123950E+02	-.203494E+02	1.00000
29	.803921E+01	-.552036E+01	1.00000
30	-.352059E+01	-.173203E+02	4.00000
31	-.344941E+01	-.172491E+02	4.00000
32	-.337838E+01	-.171781E+02	4.00000
33	-.330750E+01	-.171072E+02	4.00000
34	-.323678E+01	-.170365E+02	4.00000
35	-.316621E+01	-.169659E+02	4.00000
36	-.309579E+01	-.168955E+02	4.00000
37	-.302552E+01	-.168252E+02	4.00000
38	-.295540E+01	-.167551E+02	4.00000
39	-.288544E+01	-.166851E+02	4.00000
40	.550000E+02	-.190826E+02	1.00000
41	.135658E+02	-.943374E+01	10.00000
42	.550000E+02	-.338441E+02	1.00000
43	.550000E+02	.200165E+02	1.00000
44	.550000E+02	-.533397E+02	1.00000
45	.234369E+02	.125424E+02	2.00000
46	.237213E+02	.128268E+02	2.00000
47	.240031E+02	.131086E+02	2.00000
48	.242824E+02	.133879E+02	2.00000
49	.245592E+02	.136647E+02	2.00000
50	.248335E+02	.139390E+02	2.00000
51	.251053E+02	.142108E+02	2.00000
52	.253747E+02	.144802E+02	2.00000
53	.256416E+02	.147471E+02	2.00000
54	.259062E+02	.150117E+02	1.00000
55	.259062E+02	.751720E+01	1.00000
56	.151434E+02	.150117E+02	1.00000
57	.151434E+02	.751720E+01	1.00000

58	.496835E+02	-.114564E+02	1.00000
59	[illegible]	.219975E+02	1.00000
60	[illegible]	.997609E+01	1.00000
61	.243685E+02	.514165E+01	4.00000
62	.243686E+02	-.311326E+00	1.00000
63	.197465E+02	.957830E+01	3.00000
64	.201228E+02	.995459E+01	3.00000
65	.204951E+02	.103269E+02	3.00000
66	.208634E+02	.106952E+02	3.00000
67	.212277E+02	.110595E+02	3.00000
68	.215882E+02	.114200E+02	3.00000
69	.219448E+02	.117766E+02	3.00000
70	.222977E+02	.121295E+02	3.00000
71	.226467E+02	.124785E+02	3.00000
72	.229920E+02	.128238E+02	2.00000
73	.229920E+02	.514165E+01	1.00000
74	-.417990E+02	-.535458E+02	1.00000

LOCAL STRESSES AND PLASTIC STRAINS W/RESULTING FATIGUE LIFE

STEP	PLASTIC STRAIN	MAX OR MIN	DAMAGE
2	.01696	MAX	.589085E-03
4	.00035	MAX	.236703E-05
5	.00022	MAX	.105771E-05
14	.00249	MAX	.891548E-04
22	.00004	MAX	.498022E-07
25	.00123	MAX	.242990E-04
27	.00420	MAX	.233133E-03
28	.00156	MAX	.379281E-04
38	.00063	MIN	.718916E-05

DAMAGE FROM PLASTIC STRAINS= .98426328E-03

SIGMAX	SIGMIN	RNCYC	CYCLES	ENN/CYC
-3.51	-17.92	1.	.10000000E+10	.10000000E-08
55.00	27.28	1.	.14807856E+06	.67531722E-05
55.00	49.55	1.	.69900694E+09	.14306010E-08
55.00	-55.00	1.	.10000000E+05	.10000000E-03
32.29	29.46	1.	.46901918E+12	.21321090E-11
46.54	32.25	1.	.11536870E+09	.86678619E-08
46.54	23.26	1.	.51785551E+07	.19310406E-06
32.34	32.25	1.	.36726287E+13	.27228454E-12
54.32	-.97	1.	.14931857E+05	.66970905E-04
14.86	14.86	1.	.50066416E+12	.19973469E-11
29.18	14.90	5.	.12665797E+10	.39476395E-08
29.18	8.06	1.	.14052164E+09	.71163418E-08
15.32	14.90	1.	.42187482E+12	.23703714E-11
55.00	-13.10	1.	.10000000E+05	.10000000E-03
27.28	1.74	1.	.53004668E+08	.18866263E-07
38.26	.65	1.	.17454008E+07	.57293429E-06
30.61	12.18	1.	.27966528E+09	.35757031E-08
10.11	-7.81	5.	.10000000E+10	.50000000E-08
10.37	-7.55	5.	.10000000E+10	.50000000E-08
10.63	-7.29	5.	.10000000E+10	.50000000E-08
10.89	-7.03	5.	.10000000E+10	.50000000E-08
11.14	-6.77	5.	.56054816E+09	.89198403E-08
11.40	-6.52	5.	.56088584E+09	.89144700E-08
11.65	-6.27	5.	.56115089E+09	.89102593E-08
11.90	-6.02	5.	.56134367E+09	.89071993E-08
12.15	-5.77	5.	.56146456E+09	.89052816E-08
12.40	-5.52	4.	.56151397E+09	.71235984E-08
12.40	-20.35	1.	.27376289E+08	.36527961E-07
8.04	-5.52	1.	.10000000E+10	.10000000E-08
-3.52	-17.32	4.	.10000000E+10	.40000000E-08
-3.45	-17.25	4.	.10000000E+10	.40000000E-08
-3.38	-17.18	4.	.10000000E+10	.40000000E-08

-3.31	-17.11	4.	.10000000E+10	.40000000E-08
-3.24	-17.04	4.	.10000000E+10	.40000000E-08
-3.17	-16.97	4.	.10000000E+10	.40000000E-08
-3.10	-16.90	4.	.10000000E+10	.40000000E-08
-3.03	-16.83	4.	.10000000E+10	.40000000E-08
-2.96	-16.76	4.	.10000000E+10	.40000000E-08
-2.89	-16.69	4.	.10000000E+10	.40000000E-08
55.00	-19.08	1.	.10000000E+05	.10000000E-03
13.57	-9.43	10.	.16603817E+09	.60227117E-07
55.00	-33.84	1.	.10000000E+05	.10000000E-03
55.00	20.02	1.	.63546690E+05	.15736461E-04
55.00	-53.34	1.	.10000000E+05	.10000000E-03
23.44	12.54	2.	.52786328E+10	.37888599E-09
23.72	12.83	2.	.52805280E+10	.37875000E-09
24.00	13.11	2.	.52807566E+10	.37873361E-09
24.28	13.39	2.	.52793259E+10	.37883625E-09
24.56	13.66	2.	.52762450E+10	.37905745E-09
24.83	13.94	2.	.52715248E+10	.37939687E-09
25.11	14.21	2.	.52651779E+10	.37985421E-09
25.37	14.48	2.	.52572184E+10	.38042931E-09
25.64	14.75	2.	.52476624E+10	.38112208E-09
25.91	15.01	1.	.52365271E+10	.19096626E-09
25.91	7.52	1.	.37589154E+09	.26603419E-08
15.14	15.01	1.	.48307951E+12	.20700526E-11
15.14	7.52	1.	.15515977E+11	.64449697E-10
49.68	-11.46	1.	.24152055E+05	.41404344E-04
34.83	22.00	1.	.15814258E+10	.63234078E-09
36.76	9.98	1.	.15038306E+08	.66496853E-07
24.39	5.14	4.	.31310615E+09	.12775220E-07
24.39	-.31	1.	.77428372E+08	.12915162E-07
19.75	9.58	3.	.67337984E+10	.44551379E-09
20.12	9.95	3.	.67798754E+10	.44248601E-09
20.50	10.33	3.	.68230691E+10	.43968484E-09
20.86	10.70	3.	.68633296E+10	.43710563E-09
21.23	11.06	3.	.69036119E+10	.43474405E-09
21.59	11.42	3.	.69348755E+10	.43259609E-09
21.94	11.78	3.	.69660846E+10	.43065799E-09
22.30	12.13	3.	.69942085E+10	.42892630E-09
22.65	12.48	3.	.70192214E+10	.42739783E-09
22.99	12.82	2.	.70411021E+10	.28404644E-09
22.99	5.14	1.	.49378912E+09	.20251560E-08
-41.80	-53.54	1.	.10000000E+10	.10000000E-08

DAMAGE PER THIS SET= .16162546E-02

TOTAL ENN/CYC =, .16162546E-02

FLIGHT OR BLOCK NO. 2

STMAX	STMIN	SIGMAX	SIGMIN	RES	EQRES	ENN	NEP	
-.78	-3.98	-40.58	-54.99	-37.07	0.00	1.00	.13025831E+05	1
18.40	15.71	45.73	33.63	-37.07	-27.83	1.00	.39342782E+03	2
15.71	12.24	33.68	18.37	-37.01	-15.69	1.00	.56235689E+03	3
18.64	17.43	46.96	41.52	-36.92	-28.89	1.00	.36717948E+03	4
18.80	10.63	47.74	10.94	-36.87	-29.61	1.00	.44621680E+03	5
15.14	13.13	31.31	22.24	-35.84	-13.15	3.00	.57667259E+03	6
13.69	6.32	25.06	-8.11	-36.55	-6.61	1.00	.90105168E+03	7
16.87	13.69	39.42	25.14	-36.48	-20.90	2.00	.47906511E+03	8
13.69	11.67	25.29	16.21	-36.33	-6.61	1.00	.71090397E+03	9
18.56	9.79	47.29	7.83	-36.23	-28.52	1.00	.46919213E+03	10
9.79	3.58	7.87	-20.13	-36.20	0.00	1.00	.18861779E+04	11
12.97	9.79	22.20	7.91	-35.15	-3.35	6.00	.83680259E+03	12
9.79	8.18	8.45	1.19	-35.61	0.00	1.00	.14033389E+04	13
20.34	8.26	55.00	.65	-36.51	-36.51	1.00	.42460525E+03	14
14.18	8.50	27.28	1.74	-36.51	-8.79	1.00	.76807252E+03	15
16.60	8.98	38.26	4.00	-36.43	-19.69	1.00	.58153350E+03	16
13.77	10.79	25.61	12.18	-36.35	-6.98	7.00	.72996103E+03	17
14.74	3.42	30.61	-20.35	-35.72	-11.34	1.00	.92247814E+03	18

10.14	6.16	9.97	-7.94	-35.65	[illegible]	[illegible]	.14935730E+04	19
		[illegible]	[illegible]			4.80		4.80000000
		[illegible]	[illegible]			9.60		4.80000000
		[illegible]	-7.29			14.40		4.80000000
		[illegible]	-7.03			19.20		4.80000000
		[illegible]	-6.77			24.00		4.80000000
		11.40	-6.52			28.80		4.80000000
		11.65	-6.27			33.60		4.80000000
		11.90	-6.02			38.40		4.80000000
		12.15	-5.77			43.20		4.80000000
		12.40	-5.52			48.00		4.80000000
9.15	-.16	8.04	-33.84	-33.12	0.00	1.00	.30047963E+04	20
6.56	3.50	-3.56	-17.36	-33.09	0.00	35.00	.37392025E+04	21
		-3.52	-17.32			3.50		3.50000000
		-3.45	-17.25			7.00		3.50000000
		-3.38	-17.18			10.50		3.50000000
		-3.31	-17.11			14.00		3.50000000
		-3.24	-17.04			17.50		3.50000000
		-3.17	-16.97			21.00		3.50000000
		-3.10	-16.90			24.50		3.50000000
		-3.03	-16.83			28.00		3.50000000
		-2.96	-16.76			31.50		3.50000000
		-2.89	-16.69			35.00		3.50000000
19.45	2.10	55.00	-23.38	-32.52	-32.52	1.00	.58923931E+03	22
14.98	2.99	34.91	-19.08	-32.52	-12.42	9.00	.91708325E+03	23
10.14	5.03	13.57	-9.43	-32.47	0.01	10.00	.16047965E+04	24
20.39	14.18	55.00	28.37	-35.42	-35.42	1.00	.35855054E+03	25
-.78	-3.98	-38.93	-53.34	-35.42	0.00	1.00	.13025831E+05	26
22.76	14.98	55.00	20.87	-47.41	-47.41	1.00	.28748314E+03	27
23.67	13.69	55.00	10.09	-51.52	-51.52	1.00	.27916148E+03	28
14.18	8.90	12.27	-11.46	-51.52	-8.79	1.00	.75464468E+03	29
16.60	14.18	23.29	12.40	-51.39	-19.69	19.00	.48342514E+03	30
		23.44	12.54			1.90		1.90000000
		23.72	12.83			3.80		1.90000000
		24.00	13.11			5.70		1.90000000
		24.28	13.39			7.60		1.90000000
		24.56	13.66			9.50		1.90000000
		24.83	13.94			11.40		1.90000000
		25.11	14.21			13.30		1.90000000
		25.37	14.48			15.20		1.90000000
		25.64	14.75			17.10		1.90000000
		25.91	15.01			19.00		1.90000000
14.18	12.48	15.14	7.52	-48.65	-8.79	2.00	.65336542E+03	31
21.79	12.97	49.68	9.98	-48.37	-43.05	1.00	.32605652E+03	32
18.48	15.63	34.83	22.00	-48.33	-28.15	1.00	.39170979E+03	33
18.88	8.66	36.76	-9.24	-48.21	-29.98	1.00	.47468264E+03	34
12.38	10.63	6.23	-.31	-48.13	0.07	9.00	.90043347E+03	35
15.87	11.59	24.39	5.14	-47.03	-16.42	5.00	.56645141E+03	36
14.66	12.40	19.56	9.39	-46.41	-10.97	29.00	.62236611E+03	37
		19.75	9.58			2.90		2.90000000
		20.12	9.95			5.80		2.90000000
		20.50	10.33			8.70		2.90000000
		20.86	10.70			11.60		2.90000000
		21.23	11.06			14.50		2.90000000
		21.59	11.42			17.40		2.90000000
		21.94	11.78			20.30		2.90000000
		22.30	12.13			23.20		2.90000000
		22.65	12.48			26.10		2.90000000
		22.99	12.82			29.00		2.90000000
-.78	-3.98	-40.60	-55.00	-37.08	0.00	1.00	.13025831E+05	38
-1.05	-3.66	-41.80	-53.54	-37.08	0.00	1.00	.14337171E+05	39

LOCAL STRESSES AND FLASTIC STRAINS W/RESULTING FATIGUE LIFE

STEP * FLASTIC STRAIN MAX OR MIN DAMAGE

14	.00032	MAX	.202856E-05
22	.00004	MAX	.498022E-07
25	.00123	MAX	.242990E-04
27	.00420	MAX	.233133E-03
28	.00156	MAX	.379281E-04
38	.00063	MIN	.718916E-05

DAMAGE FROM PLASTIC STRAINS= .30462764E-03

SIGMAX	SIGMIN	RNCYC	CYCLES	ENN/CYC
-40.58	-54.99	1.	.10000000E+10	.10000000E-08
45.73	18.07	1.	.24093777E+07	.41504493E-06
33.68	33.63	1.	.43206072E+13	.23144895E-12
46.96	41.52	1.	.23661145E+11	.42263381E-10
47.74	-20.10	1.	.19780666E+05	.50554416E-04
25.06	22.24	1.	.27937764E+12	.35793846E-11
39.42	25.14	1.	.50516846E+09	.19795377E-08
39.42	16.21	1.	.24432813E+08	.40928567E-07
25.29	25.14	1.	.15753982E+13	.63476016E-12
47.29	-8.11	1.	.58801786E+05	.17006286E-04
7.87	7.83	1.	.10000000E+10	.10000000E-08
22.20	7.91	5.	.15461310E+10	.32338787E-08
22.20	1.19	1.	.21206560E+09	.47155219E-08
8.45	7.91	1.	.10000000E+10	.10000000E-08
55.00	-53.34	1.	.10000000E+05	.10000000E-03
27.28	1.74	1.	.53004668E+08	.18866263E-07
38.26	.65	1.	.17454308E+07	.57293429E-06
30.61	12.18	1.	.27966528E+09	.35757031E-08
10.11	-7.81	5.	.10000000E+10	.50000000E-08
10.37	-7.55	5.	.10000000E+10	.50000000E-08
10.63	-7.29	5.	.10000000E+10	.50000000E-08
10.89	-7.03	5.	.10000000E+10	.50000000E-08
11.14	-6.77	5.	.56054816E+09	.89198403E-08
11.40	-6.52	5.	.56088584E+09	.89144700E-08
11.65	-6.27	5.	.56115089E+09	.89102593E-08
11.90	-6.02	5.	.56134367E+09	.89071993E-08
12.15	-5.77	5.	.56146456E+09	.89052816E-08
12.40	-5.52	4.	.56151397E+09	.71235984E-08
12.40	-20.35	1.	.27376289E+08	.36527961E-07
8.04	-5.52	1.	.10000000E+10	.10000000E-08
-3.52	-17.32	4.	.10000000E+10	.40000000E-08
-3.45	-17.25	4.	.10000000E+10	.40000000E-08
-3.38	-17.18	4.	.10000000E+10	.40000000E-08
-3.31	-17.11	4.	.10000000E+10	.40000000E-08
-3.24	-17.04	4.	.10000000E+10	.40000000E-08
-3.17	-16.97	4.	.10000000E+10	.40000000E-08
-3.10	-16.90	4.	.10000000E+10	.40000000E-08
-3.03	-16.83	4.	.10000000E+10	.40000000E-08
-2.96	-16.76	4.	.10000000E+10	.40000000E-08
-2.89	-16.69	4.	.10000000E+10	.40000000E-08
55.00	-19.88	1.	.10000000E+05	.10000000E-03
13.57	-9.43	10.	.16603817E+09	.50227117E-07
55.00	-33.84	1.	.10000000E+05	.10000000E-03
55.00	20.02	1.	.63546690E+05	.15736461E-04
55.00	-55.00	1.	.10000000E+05	.10000000E-03
23.44	12.54	2.	.52786328E+10	.37888599E-09
23.72	12.83	2.	.52805280E+10	.37875000E-09
24.00	13.11	2.	.52807566E+10	.37873361E-09
24.28	13.39	2.	.52793259E+10	.37883625E-09
24.56	13.66	2.	.52762450E+10	.37905745E-09
24.83	13.94	2.	.52715248E+10	.37939687E-09
25.11	14.21	2.	.52651779E+10	.37985421E-09
25.37	14.48	2.	.52572184E+10	.38042931E-09
25.64	14.75	2.	.52476624E+10	.38112208E-09
25.91	15.01	1.	.52365271E+10	.19096626E-09
25.91	7.32	1.	.37589154E+09	.26603419E-08
15.14	15.01	1.	.48307951E+12	.20700526E-11

15.14	7.52	1.	.15515977E+11	.64449697E-10
-9.60	-11.46	1.	.24152955E+05	.41404344E-04
[illegible]	[illegible]	1.	.15814258E+10	.63234078E-09
[illegible]	[illegible]	1.	.15038306E+08	.66496853E-07
[illegible]	[illegible]	4.	.31310615E+09	.12775220E-07
[illegible]	-.31	1.	.77428372E+08	.12915162E-07
19.75	9.58	3.	.67337984E+10	.44551379E-09
20.12	9.95	3.	.67798754E+10	.44248601E-09
20.50	10.33	3.	.68230691E+10	.43968484E-09
20.86	10.70	3.	.68633296E+10	.43710563E-09
21.23	11.06	3.	.69006119E+10	.43474465E-09
21.59	11.42	3.	.69348755E+10	.43259609E-09
21.94	11.78	3.	.69660846E+10	.43065799E-09
22.30	12.13	3.	.69942085E+10	.42892630E-09
22.65	12.48	3.	.70192214E+10	.42739783E-09
22.99	12.82	2.	.70411021E+10	.28404644E-09
22.99	5.14	1.	.49378912E+09	.20251560E-08
-41.80	-53.54	1.	.10000000E+10	.10000000E-08

DAMAGE PER THIS SET= .83070929E-03

TOTAL ENN/CYC =, .24469639E-02

FLIGHT OR BLOCK NO. 3

STMAX	STMIN	SIGMAX	SIGMIN	RES	EQRES	ENN	NEP	
-.78	-3.98	-40.58	-54.93	-37.07	0.00	1.00	.13025831E+05	1
24.08	15.71	55.08	17.35	-53.34	-53.34	1.00	.25777999E+03	2
18.40	15.71	29.46	17.35	-53.34	-27.81	1.00	.39342782E+03	3
15.71	12.24	17.50	1.89	-53.19	-15.69	1.00	.56235689E+03	4
18.64	17.43	30.85	20.40	-53.04	-28.89	1.00	.36717948E+03	5
10.80	10.63	31.73	-5.07	-52.89	-29.61	1.00	.44621680E+03	6
15.14	13.13	15.38	6.31	-52.77	-13.15	3.00	.97667259E+03	7
13.69	6.32	9.32	-23.85	-52.29	-6.61	1.00	.90105168E+03	8
16.07	13.69	23.72	9.44	-52.18	-20.97	2.00	.47906511E+03	9
13.69	11.67	9.74	.66	-51.88	-6.61	1.00	.71090397E+03	10
18.56	9.79	31.79	-7.67	-51.73	-28.52	1.00	.46919213E+03	11
9.79	3.58	-7.56	-35.52	-51.62	0.00	1.00	.18861779E+04	12
12.97	9.79	6.79	-7.49	-51.56	-3.35	6.00	.83680259E+03	13
9.79	8.18	-6.70	-13.97	-50.77	0.00	1.00	.14033389E+04	14
20.34	8.26	40.83	-13.52	-50.68	-36.51	1.00	.42460525E+03	15
14.18	8.50	13.19	-12.35	-50.61	-8.79	1.00	.76807252E+03	16
19.05	14.66	35.22	15.49	-50.48	-30.71	1.00	.38464145E+03	17
16.60	8.98	24.32	-9.93	-50.35	-19.69	1.00	.58153350E+03	18
13.77	10.79	11.74	-1.70	-50.24	-6.98	7.00	.72996103E+03	19
14.74	3.42	17.04	-33.92	-49.30	-11.34	1.00	.92247814E+03	20
10.14	6.16	-3.57	-21.48	-49.20	0.00	48.00	.14935730E+04	21
		-3.39	-21.30			4.80		4.80000000
		-3.02	-20.94			9.60		4.80000000
		-2.66	-20.58			14.40		4.80000000
		-2.31	-20.22			19.20		4.80000000
		-1.96	-19.87			24.00		4.80000000
		-1.60	-19.52			28.80		4.80000000
		-1.26	-19.17			33.60		4.80000000
		-.91	-18.83			38.40		4.80000000
		-.57	-18.48			43.20		4.80000000
		-.23	-18.14			48.00		4.80000000
9.15	-.16	-4.54	-46.42	-45.69	0.00	1.00	.30047963E+04	22
6.56	3.50	-16.12	-29.92	-45.65	0.00	35.00	.37392025E+04	23
		-16.07	-29.87			3.50		3.50000000
		-15.97	-29.77			7.00		3.50000000
		-15.88	-29.68			10.50		3.50000000
		-15.78	-29.58			14.00		3.50000000
		-15.68	-29.48			17.50		3.50000000
		-15.58	-29.38			21.00		3.50000000
		-15.49	-29.29			24.50		3.50000000
		-15.39	-29.19			28.00		3.50000000
		-15.29	-29.09			31.50		3.50000000

	[illegible]	-15.20	-29.00			35.00		3.50000000
19.45	2.10	42.84	-35.24	-44.68	-32.52	1.00	.58920931E+03	24
14.98	2.99	22.79	-31.20	-44.64	-12.42	9.00	.91708325E+03	25
10.14	5.03	1.72	-21.28	-43.92	0.00	10.00	.16047965E+04	26
23.75	-3.23	60.71	-60.71	-46.18	-51.89	1.00	.50647169E+03	27
20.09	14.18	44.22	17.59	-46.21	-35.42	1.00	.35855054E+03	28
-.78	-3.98	-40.60	-55.00	-37.08	0.00	1.00	.13025831E+05	29
22.76	14.98	55.00	20.02	-47.41	-47.41	1.00	.28748314E+03	30
23.67	13.69	55.00	10.09	-51.52	-51.52	1.00	.27916148E+03	31
14.18	8.90	12.27	-11.46	-51.52	-8.79	1.00	.75464468E+03	32
16.60	14.18	23.29	12.40	-51.39	-19.69	19.00	.48342514E+03	33
		23.44	12.54			1.90		1.90000000
		23.72	12.83			3.80		1.90000000
		24.00	13.11			5.70		1.90000000
		24.28	13.39			7.60		1.90000000
		24.56	13.66			9.50		1.90000000
		24.83	13.94			11.40		1.90000000
		25.11	14.21			13.30		1.90000000
		25.37	14.48			15.20		1.90000000
		25.64	14.75			17.10		1.90000000
		25.91	15.01			19.00		1.90000000
14.18	12.48	15.14	7.52	-48.65	-8.79	2.00	.65336542E+03	34
21.79	12.97	49.68	9.98	-48.37	-43.05	1.00	.32605652E+03	35
18.48	15.63	34.83	22.00	-48.33	-28.15	1.00	.39173979E+03	36
18.88	8.66	36.76	-9.24	-48.21	-29.98	1.00	.47468264E+03	37
12.08	10.63	6.23	-.31	-48.13	0.00	9.00	.90043347E+03	38
15.87	11.59	24.39	5.14	-47.03	-16.42	5.00	.56645141E+03	39
14.66	12.40	19.56	9.39	-46.41	-10.97	29.00	.62236611E+03	40
		19.75	9.58			2.90		2.90000000
		20.12	9.95			5.80		2.90000000
		20.50	10.33			8.70		2.90000000
		20.86	10.70			11.60		2.90000000
		21.23	11.06			14.50		2.90000000
		21.59	11.42			17.40		2.90000000
		21.94	11.78			20.30		2.90000000
		22.30	12.13			23.20		2.90000000
		22.65	12.48			26.10		2.90000000
		22.99	12.82			29.00		2.90000000
-.78	-3.98	-40.60	-55.00	-37.08	0.00	1.00	.13025831E+05	41
-1.05	-3.66	-41.80	-53.54	-37.08	0.00	1.00	.14337171E+05	42

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LOCAL STRESSES AND PLASTIC STRAINS W/RESULTING FATIGUE LIFE

STEP	PLASTIC STRAIN	MAX OR MIN	DAMAGE
2	.00593	MAX	.438461E-03
27	.00321	MAX	.141845E-03
29	.00185	MIN	.183981E-04
30	.00365	MAX	.180144E-03
31	.00156	MAX	.379281E-04
41	.00063	MIN	.718916E-05

DAMAGE FROM PLASTIC STRAINS= .82396546E-03

SIGMAX	SIGMIN	RNCYC	CYCLES	ENN/CYC
-40.58	-54.99	1.	.10000000E+10	.10000000E-08
55.00	-46.42	1.	.10000000E+05	.10000000E-03
29.46	17.35	1.	.29397878E+10	.34016060E-09
17.50	17.35	1.	.63000870E+12	.15872797E-11
30.85	25.43	1.	.77590688E+11	.12888145E-10
31.73	1.89	1.	.14305010E+08	.69905579E-07
9.32	6.31	1.	.10000000E+10	.10000000E-08
23.72	9.44	1.	.15092544E+10	.66257884E-09
23.72	.66	1.	.11830863E+09	.84524691E-08
9.74	9.44	1.	.10000000E+10	.10000000E-08
31.79	-23.85	1.	.46704942E+06	.21411011E-05
-7.56	-7.67	1.	[illegible]	[illegible]

6.79	-7.49	5.	.10000000E+10	.50000000E-08
6.79	-13.97	1.	.10000000E+10	.10000000E-08
6.70	-7.49	1.	.10000000E+10	.10000000E-08
42.83	-66.52	1.	.26034162E+05	.38455383E-04
33.19	12.35	1.	.97971982E+08	.10207000E-07
35.22	-16.52	1.	.65291215E+06	.15315996E-05
31.74	-1.70	7.	.19249496E+10	.36364588E-08
17.04	-9.93	1.	.66014698E+08	.15148142E-07
-3.02	-20.94	5.	.10000000E+10	.50000000E-08
-2.66	-20.58	5.	.10000000E+10	.50000000E-08
-2.31	-20.22	5.	.10000000E+10	.50000000E-08
-1.96	-19.87	5.	.10000000E+10	.50000000E-08
-1.60	-19.52	5.	.10000000E+10	.50000000E-08
-1.26	-19.17	5.	.10000000E+10	.50000000E-08
-.91	-18.83	5.	.10000000E+10	.50000000E-08
-.57	-18.48	5.	.10000000E+10	.50000000E-08
-.23	-18.14	4.	.10000000E+10	.40000000E-08
-.23	-21.30	1.	.10000000E+10	.10000000E-08
-4.54	-18.14	1.	.10000000E+10	.10000000E-08
-16.07	-29.87	4.	.10000000E+10	.40000000E-08
-15.97	-29.77	4.	.10000000E+10	.40000000E-08
-15.88	-29.68	4.	.10000000E+10	.40000000E-08
-15.78	-29.58	4.	.10000000E+10	.40000000E-08
-15.68	-29.48	4.	.10000000E+10	.40000000E-08
-15.58	-29.38	4.	.10000000E+10	.40000000E-08
-15.49	-29.29	4.	.10000000E+10	.40000000E-08
-15.39	-29.19	4.	.10000000E+10	.40000000E-08
-15.29	-29.09	4.	.10000000E+10	.40000000E-08
-15.20	-29.00	4.	.10000000E+10	.40000000E-08
42.84	-31.20	1.	.24386594E+05	.41006136E-04
1.72	-21.28	10.	.10000000E+10	.10000000E-07
60.71	-55.00	1.	.10000000E+05	.10000000E-03
55.00	20.02	1.	.63546690E+05	.15736461E-04
55.00	-55.00	1.	.10000000E+05	.10000000E-03
23.44	12.54	2.	.52786328E+10	.37888599E-09
23.72	12.83	2.	.52805280E+10	.37875000E-09
24.00	13.11	2.	.52807566E+10	.37873361E-09
24.28	13.39	2.	.52793259E+10	.37883625E-09
24.56	13.66	2.	.52762450E+10	.37905745E-09
24.83	13.94	2.	.52715248E+10	.37939687E-09
25.11	14.21	2.	.52651779E+10	.37985421E-09
25.37	14.48	2.	.52572184E+10	.38042931E-09
25.64	14.75	2.	.52476624E+10	.38112208E-09
25.91	15.01	1.	.52365271E+10	.19096626E-09
25.91	7.52	1.	.37589154E+09	.26603419E-08
15.14	15.01	1.	.48307951E+12	.20700526E-11
15.14	7.52	1.	.15515977E+11	.64449697E-10
49.68	-11.46	1.	.24152055E+05	.41404344E-04
34.83	22.00	1.	.15814258E+10	.63234078E-09
36.76	9.98	1.	.15038306E+08	.66496853E-07
24.39	5.14	4.	.31310615E+09	.12775220E-07
24.39	-.31	1.	.77428372E+08	.12915162E-07
19.75	9.58	3.	.67337984E+10	.44551379E-09
20.12	9.95	3.	.67798754E+10	.44248601E-09
20.50	10.33	3.	.68230691E+10	.43968484E-09
20.86	10.70	3.	.68633296E+10	.43710563E-09
21.23	11.06	3.	.69006119E+10	.43474405E-09
21.59	11.42	3.	.69348755E+10	.43259609E-09
21.94	11.78	3.	.69660846E+10	.43065799E-09
22.30	12.13	3.	.69942085E+10	.42892630E-09
22.65	12.48	3.	.70192214E+10	.42739783E-09
22.99	12.82	2.	.70411021E+10	.28404644E-09
22.99	5.14	1.	.49378912E+09	.20251500E-08
-41.80	-53.54	1.	.10000000E+10	.10000000E-08

DAMAGE PER THIS SET= .12645622E-02

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FLIGHT OR BLOCK NO.    4                          TOTAL ENN/CYC =,  .37115261E-02
                                                  DAMAGE FROM PLASTIC STRAINS=  .30462764E-03
                                                  DAMAGE PER THIS SET=  .83070929E-03
FLIGHT OR BLOCK NO.    5                          TOTAL ENN/CYC =,  .45422354E-02
                                                  DAMAGE FROM PLASTIC STRAINS=  .22665690E-02
                                                  DAMAGE PER THIS SET=  .26509046E-02
FLIGHT OR BLOCK NO.    6                          TOTAL ENN/CYC =,  .71931400E-02
                                                  DAMAGE FROM PLASTIC STRAINS=  .30462764E-03
                                                  DAMAGE PER THIS SET=  .83070929E-03
FLIGHT OR BLOCK NO.    7                          TOTAL ENN/CYC =,  .80238493E-02
                                                  DAMAGE FROM PLASTIC STRAINS=  .30462764E-03
                                                  DAMAGE PER THIS SET=  .83070929E-03
                                                  TOTAL ENN/CYC =,  .88545586E-02
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MEDIA CONVERSION LISTING — LABEL/ CARDS

INPUT FILE / RECORD NUMBER 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

							Record
							000001
1	1	1					000002
B*1 SPECTRUM		-- TRUNCATION LEVEL	270,000 CYCLES				000003
2219-T851 AL		55.	.40	-1.836	10000.		000004
-.00217		.22041	55.82462	NORTH AMERICAN	4	2219	000005
-.00178		.33210	48.26657	NORTH AMERICAN	5	2219	000006
-.00149		.46283	39.66455	NORTH AMERICAN	6	2219	000007
-.00243		.64199	31.70955	NORTH AMERICAN	7	2219	000008
2500000.		1.	1.				000009
4.5 2.6[illegible]							000010
	7	44	3				000011
26.9 23.3							000012
1	1	-.148	-.029	1.			000013
2	3	.584	1.	1.			000014
3	2	.584	.895	1.			000015
4	1	.584	.684	1.			000016
5	1	.455	.584	1.			000017
6	1	.648	.693	1.			000018
7	1	.395	.699	1.			000019
8	1	.488	.563	3.			000020
9	1	.235	.509	1.			000021
10	1	.509	.627	2.			000022
11	1	.434	.509	1.			000023
12	1	.364	.69	1.			000024
13	1	.133	.364	1.			000025
14	1	.364	.482	6.			000026
15	1	.304	.364	1.			000027
16	1	.307	.756	1.			000028
17	1	.316	.527	1.			000029
18	2	.545	.708	1.			000030
19	1	.334	.617	1.			000031
20	1	.401	.512	7.			000032
21	1	.127	.548	1.			000033
22	1	.229	.377	48.			000034
23	1	-.006	.340	1.			000035
24	1	.13	.244	35.			000036
25	1	.078	.723	1.			000037
26	1	.111	.557	9.			000038
27	1	.187	.377	10.			000039
28	3	.527	.991	1.			000040
29	2	-.12	.883	1.			000041
30	1	.527	.747	1.			000042
31	1	-.148	-.029	1.			000043
32	1	.557	.846	1.			000044
33	1	.509	.880	1.			000045
34	1	.331	.527	1.			000046
35	1	.527	.617	19.			000047
36	1	.464	.527	2.			

INPUT FILE RECORD NUMBER 0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 OUTPUT FILE RECORD NUMBER

PREPARED: 73 SEP 17 MEDIA CONVERSION LISTING LABEL/ CARDS PCN N102001

INPUT FILE RECORD NUMBER / OUTPUT FILE RECORD NUMBER

0 123456789	1 0123456789		2 0123456789	4 0123456789	6 0123456789	OUTPUT FILE RECORD NUMBER
37	1		.482	.81	1.	000048
38	1		.581	.687	1.	000049
39	1		.322	.702	1.	000050
40	1		.395	.449	9.	000051
41	1		.431	.59	5.	000052
42	1		.461	.545	29.	000053
43	1		-.148	-.029	1.	000054
44	1		-.136	-.039	1.	000055
1	1					000056
2	1					000057
3	2	1				000058
4	1					000059
5	3	1				000060
6	1					000061
7	1					000062

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APPENDIX III

LIST OF COMPUTER PROGRAM SYMBOLS AND DEFINITIONS

A	Coefficient of the x^2 term in the equation of a line on a constant life fatigue diagram where minimum stress is x and maximum stress is y. $(R = Ax^2 + Bx + C - y)$
AA	An assigned value of +1. or -1.
AAA	A stress used in the calculation of plastic strain.
ABDIF	The absolute value of DIF.
ABM	The absolute value of ASMAX or of ASMIN, as assigned.
ABMAX	The absolute value of ASMAX.
ABMEAN	The absolute value of ASMEAN.
ABMIN	The absolute value of ASMIN.
ABR4	The absolute value of R(4).
ABR7	The absolute value of R(7).
ABS	The name of a routine calling for the absolute value of a quantity.
AKT	Stress concentration factor, K_t
ASE	Array of values of ENN, for the plotting subroutine.
ASMAX	The product (AKT) (STMAX)
ASMEAN	The quantity (ASMAX + ASMIN)/2
ASMIN	The product (AKT)(STMIN)
ASN	Array of values of ASMIN, for the plotting subroutine.
ASX	Array of values of ASMAX, for the plotting subroutine.
AVSGMN	Average value of SIGMIN over an interval.
AVSGMX	Average value of SIGMAX over an interval.

B	Coefficient of the x term. (See A.)
BBB	A stress used in the calculation of plastic strain.
C	The constant. (See A.)
COFMAN	Inverse of the Coffin-Manson slope.
CYCINT	The number of cycles in an interval.
CYCLES	The calculated number of cycles expected to be indicated on a constant life fatigue diagram for the applied combination of maximum and minimum stress.
C1	The Residual Stress Relaxation Constant (See ENEP.)
DAM	Damage.
DECK	Decimal or real value of integer K after conversion.
DEL2	A portion of a least-squares-method solution.
DIF	The difference between residual stress and equilibrium residual stress. (RES(I) - EQRES)
DO2	A portion of a least-squares-method solution.
DUMMY	A variable used in the calculation of the number of cycles to be considered as an interval for relaxation determination.
ELMOD	The elastic modulus.
EN	The number of cycles from the beginning of the relaxation process to the end of the current interval.
ENEP	The number of cycles required for overload residual stress effect to return to within one-tenth of its original difference from equilibrium conditions. ($N_{ep} = C1/(ABM)^{E1}(ABMEAN)^{E2}$)

ENN	The number of applied cycles at a load level.
ENNCYC	The ratio of the number of applied cycles to the number of cycles to failure. (ENN/CYCLES)
EPSD	LCF strain intercept.
EQRES	Equilibrium residual stress.
EX	An exponential function depicting the relaxation of residual stress.
EXP	The name of a routine calling for the exponential value of a quantity.
EXPO	An exponent. The power of 10 which indicates the number of cycles to failure.
E1 E2	Residual stress Relaxation Exponents.
FLOAT	The name of a routine calling for integer-to-real conversion.
I	A variable subscript.
IBLOCK	The identifying number of a block the blocks being numbered consecutively from 1 to NBLOCK.
IFIX	The name of a routine calling for real-to-integer conversion.
IN	The number of steps input to the range pair counting subroutine.
IPRINT	Value controlling the WRITE statements.
IRAIN	A counter.
IRPCM	Value controlling entry into the range pair counting subroutine.

ISTEP	The identifying step number, the steps being numbered from 1 to NLEVEL.
ITYPE	The identifying type number, the types being numbered from 1 to NTYPE.
J	A variable subscript.
JA	Value of +1 or 0, as assigned for branch determination.
JB	Value of -1 or 0, as assigned for branch determination.
JJ	An index variable.
JJJ	An index variable.
JKL	An index variable.
K	An index variable.
KK	An index variable.
KPMAX	The number of steps output from the range pair counting subroutine.
L	An index variable.
LMN	An index variable.
M	An index variable.
N	An index variable with values of N=4-7 indicating the power of 10, and thus identifying a particular life cycle curve.
NBLOCK	The total number of times to execute a block of loads.
NDECK	The number of data decks to be run sequentially.
NFLAG	An integer used as a counter.
NFLAG2	An integer used as a counter.

NLEVEL	The total number of steps, or levels, of loads in a block.
NN	A subscripted variable used to indicate which types of loads are experienced in which blocks.
NTYPE	The total number of different types.
PLSTRA	Plastic strain.
R	Residue term in damage calculation.
RES	Residual stress.
RNCYC	The number of cycles for a level after exitting the range pair counting subroutine.
SIGMAX	Maximum stress.
SIGMIN	Minimum stress.
STMAX	Maximum applied stress.
STMIN	Minimum applied stress.
SUMDEL	Summation of damage for a flight.
SUMENN	Accumulated total of applied cycles. (Summation of ENN).
SUMNC	Accumulated cycle ratio. (Summation of ENN/CYCLES).
SUMR	Summation of R(N), N=4,7.
SUMRN	Summation of nR(N), N=4,7. n=4.
SUMR2	Summation of $R(N)^2$, N=4,7.
SUMR2N	Summation of $nR(N)^2$, N=4,7. n=4.
SUMR3	Summation of $R(N)^3$, N=4,7.
SUMR4	Summation of $R(N)^4$, N=4,7.
TITLE1,TITLE2	Identification of the source of the SN data.
TLL	Tensile load limit.
TM1,TM2	Material type.

TTYS	One-fifth of tensile yield stress.
TYS	Tensile yield stress.
T1,T2,T3,T4,T5,T6,T7,T8	Test identifying information.
X	Variable equivalent to SIGMIN.
Y	Variable equivalent to SIGMAX.

APPENDIX IV

FATIGUE LIFE INPUT DATA FLR SEVERAL MATERIALS

MATERIAL	YIELD STRESS	STRAIN INTERCEPT	INVERSE OF SLOPE	LIFE, 10^I	S-N LIFE COEFFICIENTS A(I)	B(I)	C(I)
2024-T4	58.	0.4	-1.836	4	-.0020	.2091	62.6
				5	-.0032	.4366	51.4
				6	-.0035	.6207	42.2
				7	-.0042	.7003	36.1
2219-T851	55.	0.4	-1.836	4	-.0022	.2204	55.8
				5	-.0018	.3320	48.3
				6	-.0015	.4628	39.7
				7	-.0024	.6420	31.7
7075-T6	72.	0.4	-1.836	4	-.0020	.2801	71.7
				5	-.0022	.5154	56.3
				6	-.0014	.6141	44.6
				7	-.0013	.6838	38.1
RQC-100	125.	0.54	-1.493	4	0.0	.2136	98.3
				5	0.0	.2927	88.5
				6	0.0	.3669	79.1
				7	0.0	.4376	70.3
Man-Ten	55.	1.11	-1.667	4	0.0	.2257	63.5
				5	0.0	.3520	53.1
				6	0.0	.4669	43.7
				7	0.0	.5678	35.4
4340 Steel	160.	0.4	-1,836	4	-.0002	.2567	162.4
				5	-.0007	.5248	126.9
				6	-.0005	.5557	113.5
				7	-.0005	.5557	108.5
Ti-6-4	158.	0.4	-1.836	4	-.0009	.2368	154.2
				5	-.0006	.4640	110.3
				6	-.0000	.4650	88.9
				7	.0001	.4752	84.2