Results for sm_dadn25CrMo4_S=+-100 : Crack Propagation Plate Edge Flaw

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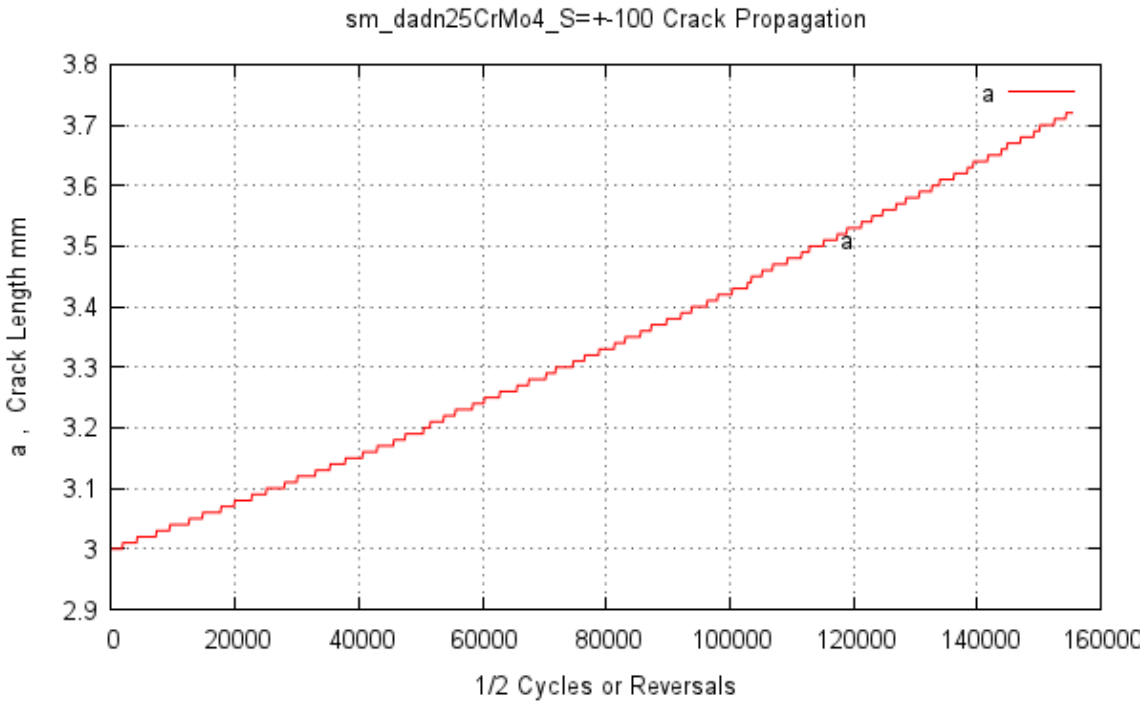
Affiliation:
Sun May 25 13:38:16 EDT 2014

Simulation input data:
B= 10.0 mm
W= 24.0 mm
a_0= 3.0 mm
#MATERIAL= all_30-34CrNiMo+.html
#TYPE= plate_edge_flaw
#ACTIVATE_MmMb= 1
M=Mkm=Mkb=fw=1.0

Crack Propagation Results:
(*# plateEdgeFlaw.f vers. 3.11 # makereport5 vers. 2.1*)

- No. of Reversals= 155376 revs. or 77688 cycles
- Final _____ **a** = 0.372E+01 mm
- No. of History Reps.= 3 reps. + 51402 revs.



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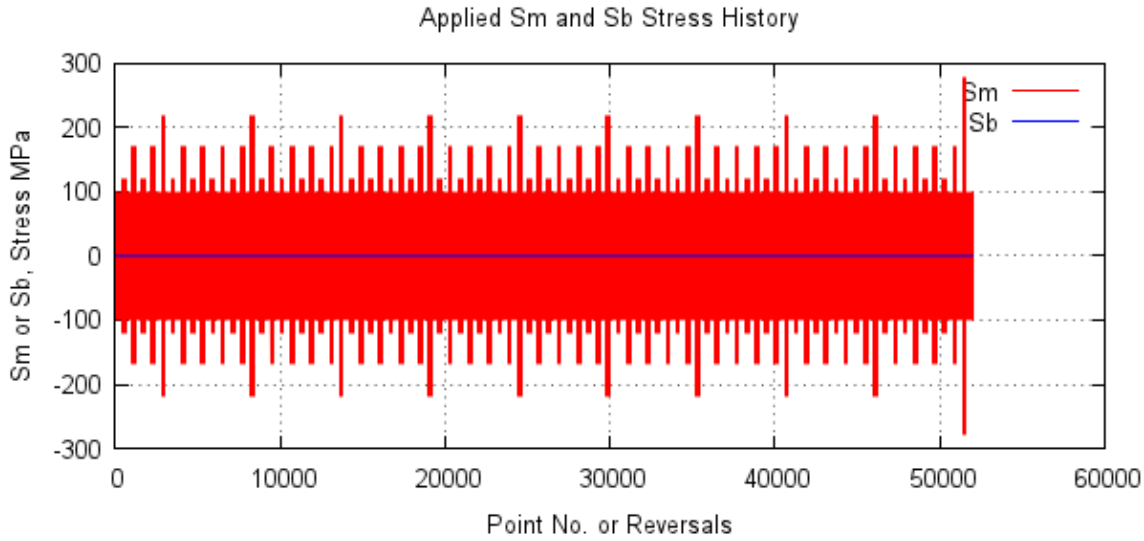

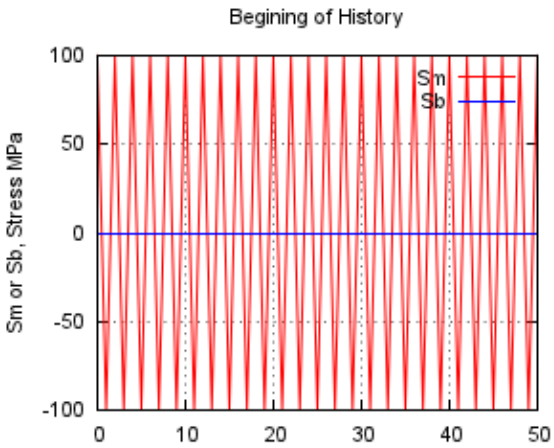

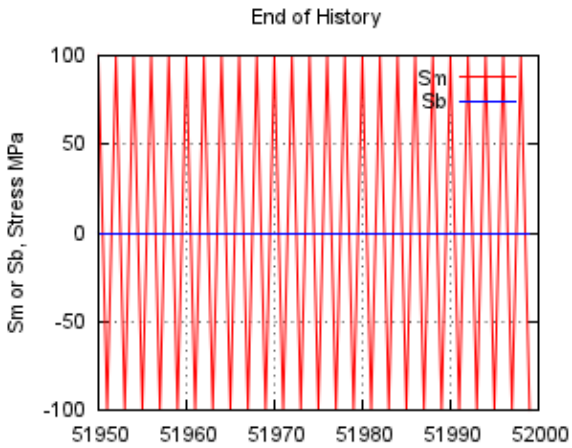

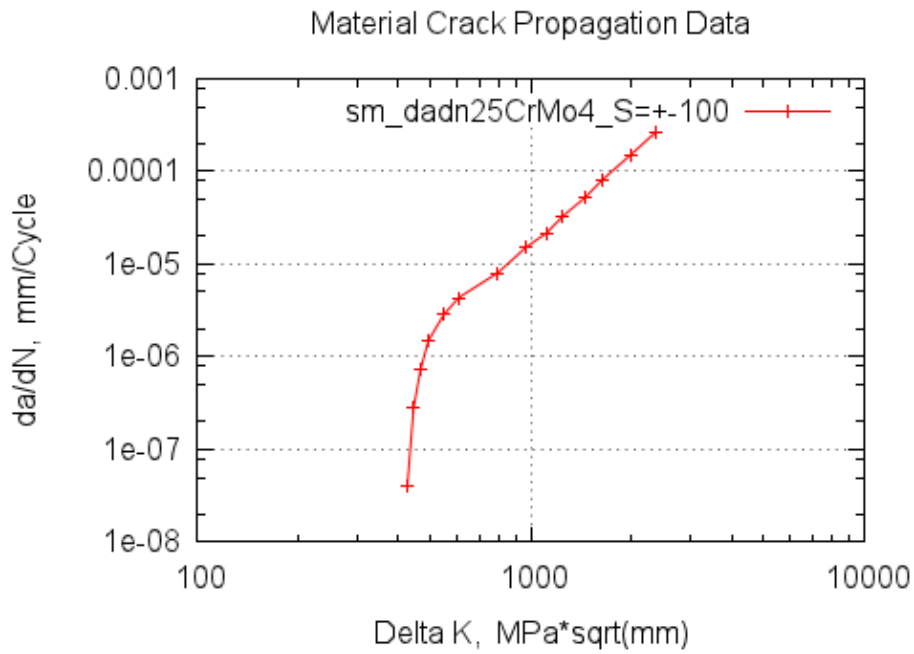

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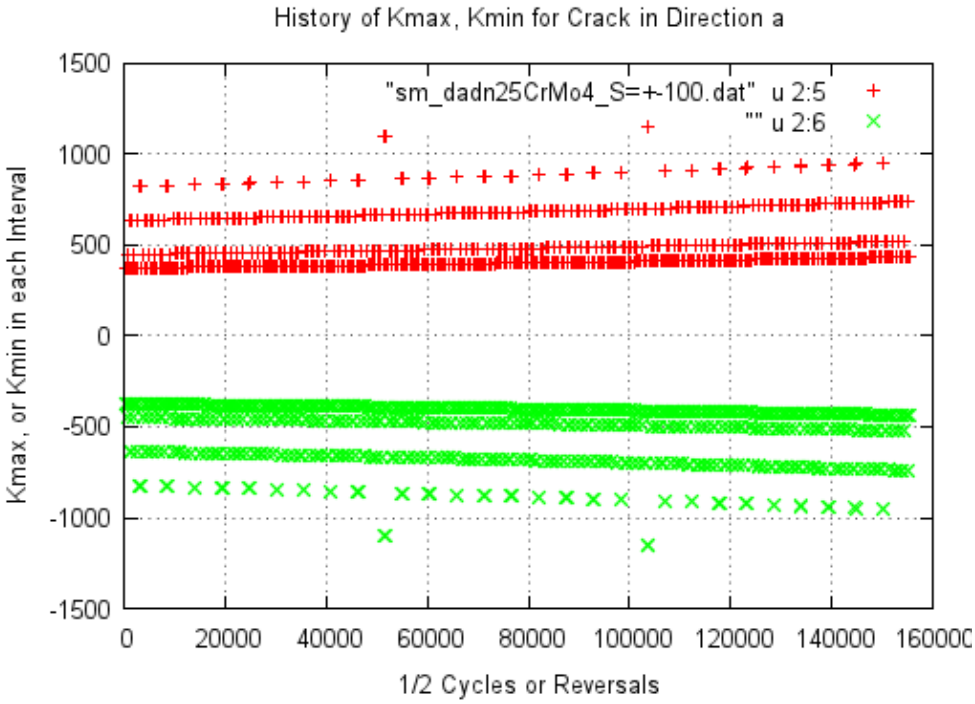
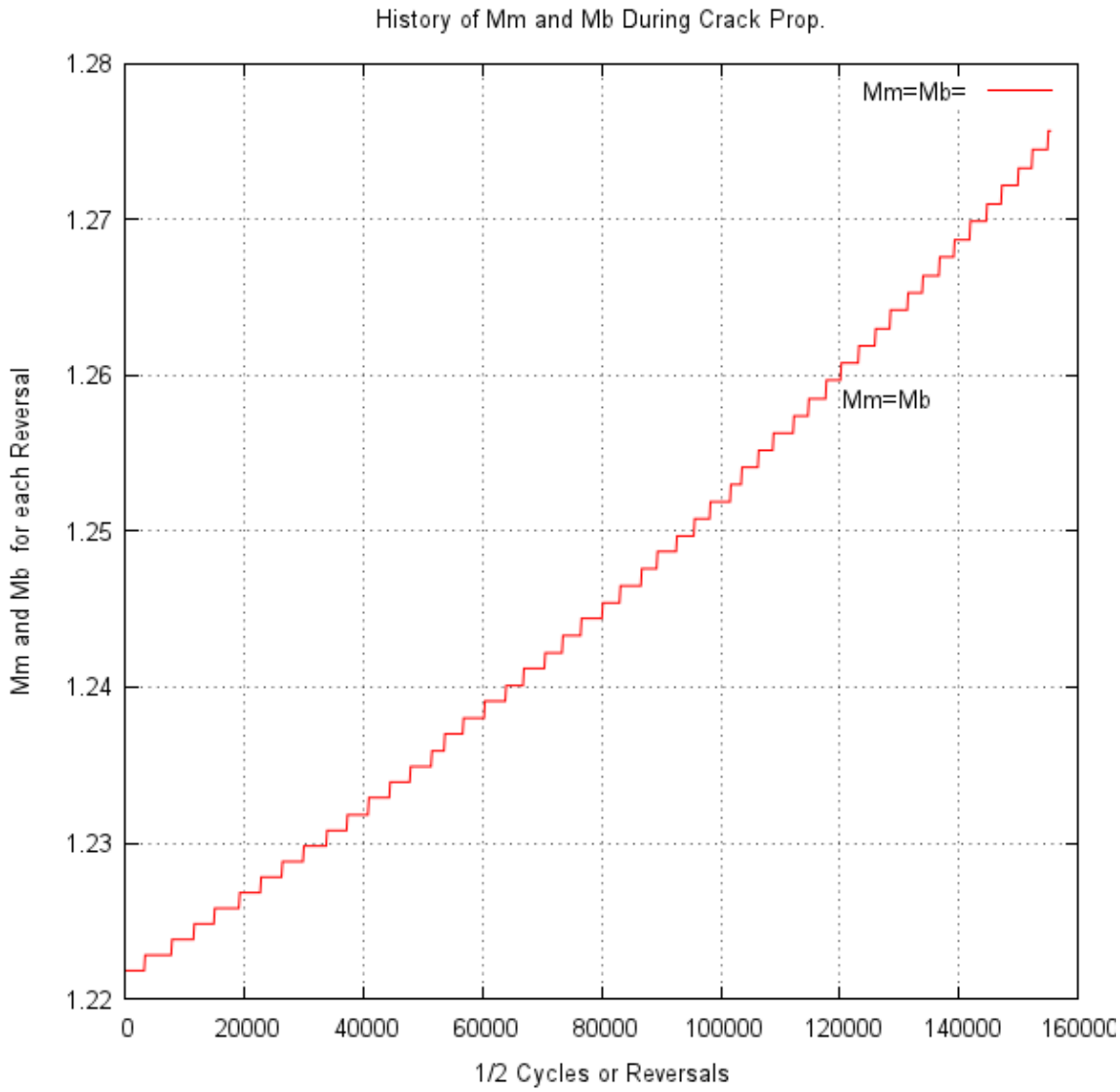
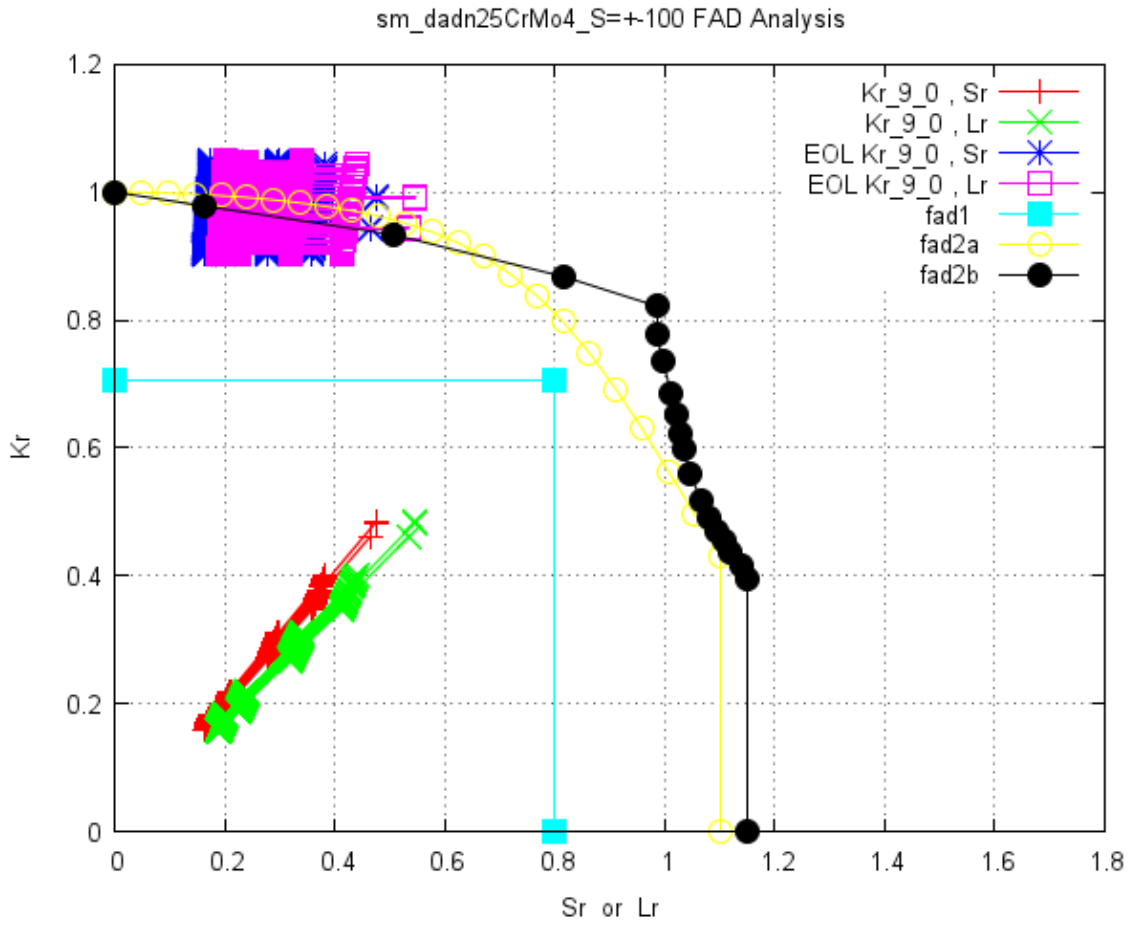



History of Mm and Mb During Crack Prop.
Mm=Mb=
Mm=Mb
Mm and Mb for each Reversal
1/2 Cycles or Reversals
1.28
1.27
1.26
1.25
1.24
1.23
1.22
0
20000
40000
60000
80000
100000
120000
140000
160000

FAD Results for sm_dadn25CrMo4_S=+-100 #TensileFile= boller_30CrNiMo8cylin_Tens.txt

#PmEOL= 524. #PbEOL= 50.
#Kmat= 2385.

plateEdgeFAD.f vers. 0.5



Crack Initiation Life Results for sm_dadn25CrMo4_S=+-100 (Assume Kt= 1.8 for welds)

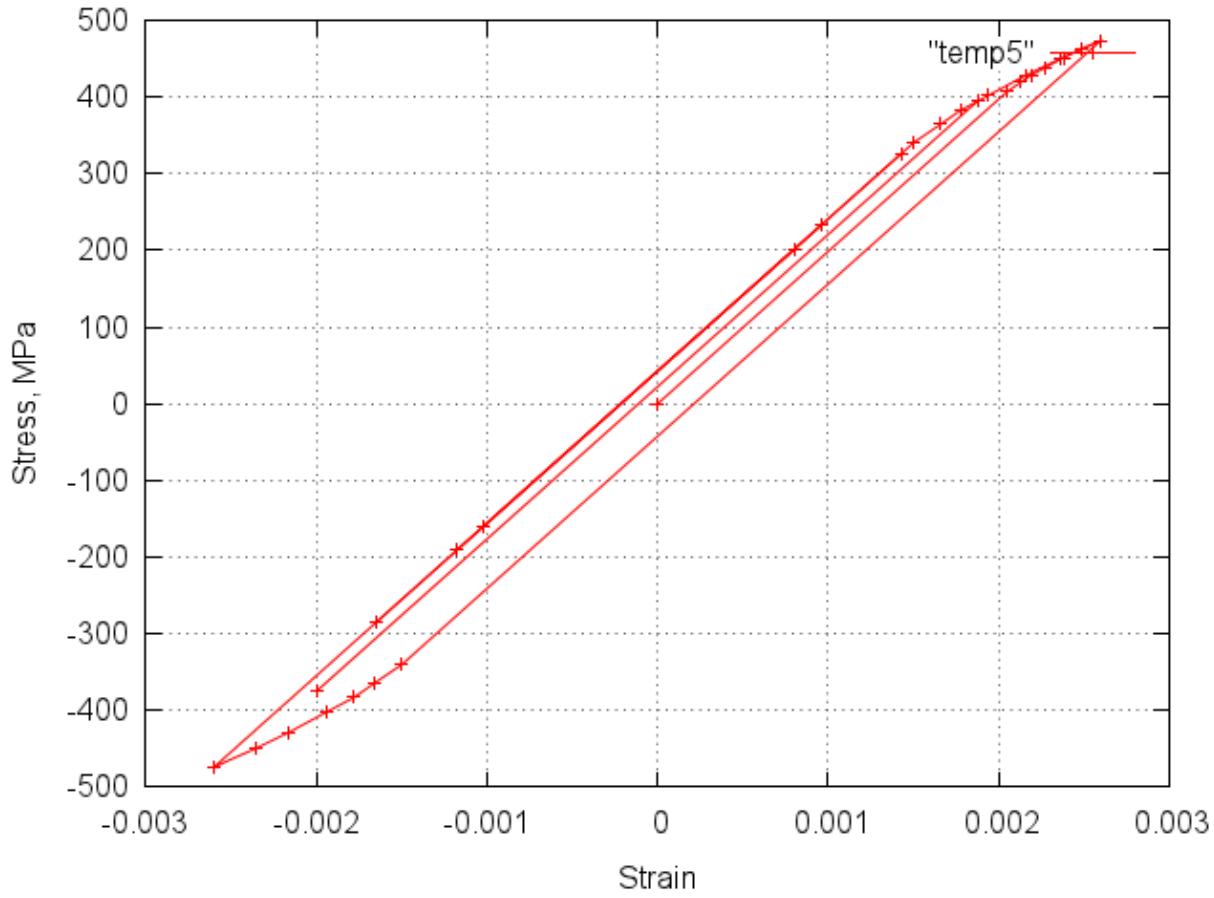
Files Used:

- Stress History (Sb+Sm)
- Rainflow File
- Material File

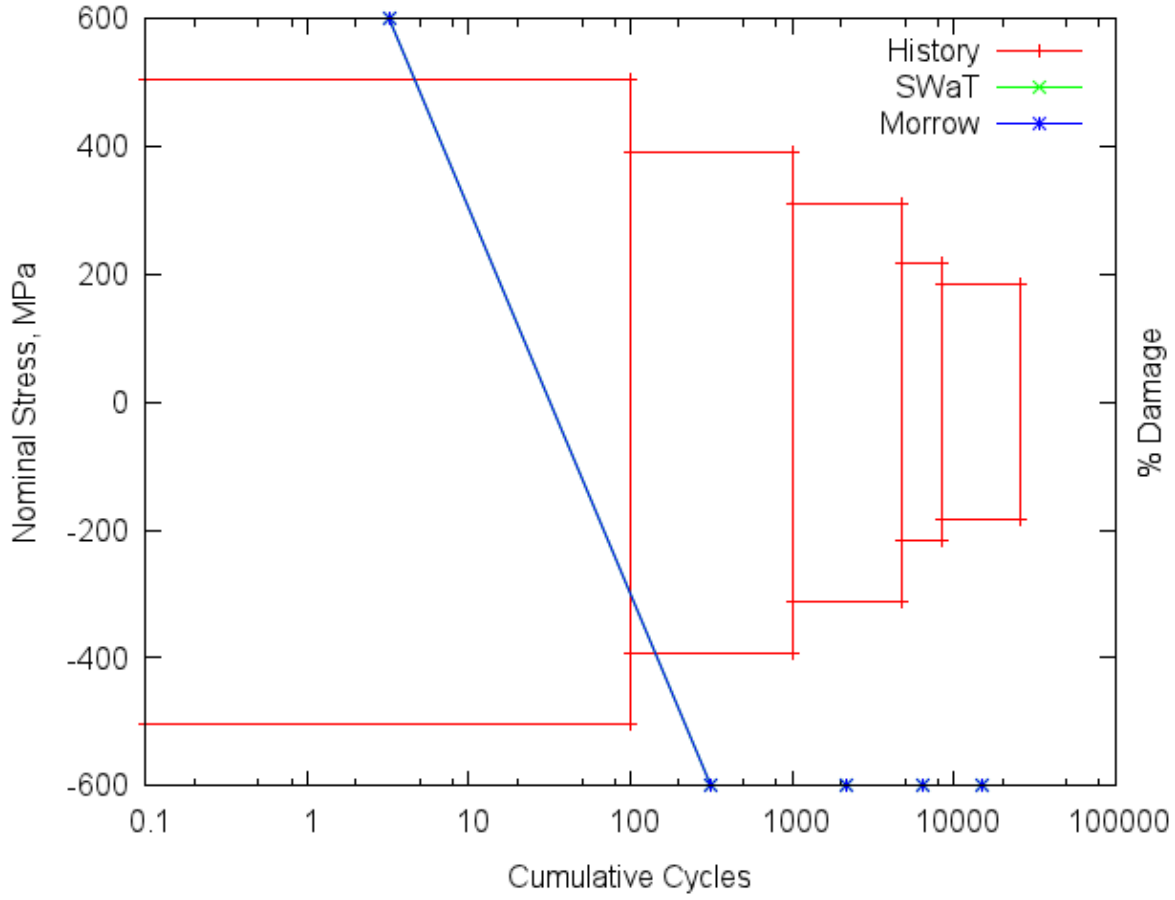
Predicted History Repetitions to Initiation:

StrainLife_Reps	SWaT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps (Reps= Repetions)
2480.5	2480.5	2480.5	2480.5	2480.5

Local Stress and Strain Response:



Cumulative Cycle Plot of History and Damage:



(Rectangles are Rainflow Cycle Sets: Sorted by Range: largest on Left)

Detailed Damage for each Rainflow Cycle Set:

Loop	Smax	Smin	N	Sigmax	Sigmin	Delta	Epsmax	Epsmin	DeltaEps	%Eps	%SWaT	%Sts	%Morr
1	504.0	-504.0	100.0	474.	-474.	948.	0.00260	-.00260	0.00520	100.0	100.0	100.0	100.0
2	392.4	-392.4	900.0	396.	-375.	771.	0.00188	-.00200	0.00388	0.0	0.0	0.0	0.0
3	311.4	-311.4	3800.0	327.	-285.	611.	0.00143	-.00165	0.00308	0.0	0.0	0.0	0.0
4	216.0	-216.0	3800.0	233.	-191.	424.	0.00096	-.00118	0.00214	0.0	0.0	0.0	0.0
5	183.6	-183.6	17400.0	201.	-159.	361.	0.00080	-.00102	0.00182	0.0	0.0	0.0	0.0

Appendix 1: Print of "pdprop.env" Simulation Control file

```
# This file contains the starting filenames, variables etc
# for the Crack Propagation  programs.   It should be edited by the
# user before each simulation run. It can also be generated from web
# page at:  to be determined
#

#TYPE= plate_edge_flaw     #with or without weld using ACTIVATEs:
#ACTIVATE_MmMb=     1    #  Deactivate  = 0
#ACTIVATE_MkmMkb=   0    #  Note used in plate_edge_flaw
#ACTIVATE_fw=       0    #  Note used in plate_edge_flaw
#                              #Other      #TYPE=  options:
#                              # plate_surface_flaw
```

```
#                               # plate_tru_flaw
#                               # plate_embedded_flaw
#                               # plate_long_surface_flaw
#                               #
#                               # pipe_inside_flaw
#                               # pipe_full_inside_flaw
#                               # pipe_full_outside_flaw
#                               #
#                               # rod_surface_flaw
#                               # rod_full_outside_flaw

#                               # These problem types are used to activate
#                               # appropriate Fw, Mm, Mb, files etc.

# The factors described in this section may be ignored if not applicable to
# the particular problem type described above.
# (All dimensions in mm)
#B= 10.0   # plate (or pipe wall) thickness
#W= 24.0   # plate width
#ri=  00.    # Internal diameter if pipe problem. Ignored if not pipe
#azero= 3.0  # initial crack depth
#czero= 0.0  # initial 1/2 crack width at surface
#L= 00.      # Weld Feature width.  Ignored  if ACTIVATE_MkmMkb= 0 (above)

#HISTORYFILE=  c100histPm.txt    # historyFileName for setup only
#           # Adjustments to load file variables:
#           # Note that the MEANADD (below) is added AFTER the MAGFACTOR is applied.
#MAGFACTOR_m= 1.0     # Multiply factor on membrane load. Result should be MPa
#MAGFACTOR_b= 1.0     # Multiply factor on bending load term. Result should be MPa
#MEANADD_m=   0.0     # Mean shift in MPa added to membrane stress.
#MEANADD_b=   0.0     # Mean shift in MPa added to bending stress.

#MAXREPS=  1000000    # Max no. history repeats in simulation.
#                     # One repetition or application of the load history is
#                     # also called a "block" of cycles.
#
#
#MATERIAL=  all_30-34CrNiMo+.html   #File name of material fitted data
#                                 This file is used to define the cyclic
#                                 stress-strain curve, and the Neuber Product curve.
#
#DADN= table                          # Can be "table" or "Paris"
#DADN_PARIS= 0.0 0.0 0.0 0.0 none     # Kth  a  m  Kc units   (ignored if #DADN= table )
#DADN_TABLE=  luke_dadn_25CrMo4_R=-1_fit.txt  # da/dN digitized da/dN curve for material,
#                                 including the threshold, and KIc.
#                                 If a threshold exists, put in a vertical line
#                                 (with two identical X-axis points).
#                                 If the threshold needs to be "turned off" then
#                                 do NOT put in a vertical line at low da/dN.
#                                 (Ignored when #DADN= PARIS )
#
#FAD Stuff:
#TensileFile=  boller_30CrNiMo8cylin_Tens.txt     #enter "none"  if no FAD
#PmEOL= 524.              #Set these so that Pm+Pb= 0.82*Syield for default.
#PbEOL=  50.
#Kmat= 2385.          #used end of dadn curve for 34CrNiMo6
#PinJoint= 0             # not used for plateEdgeFlaw.f
#
#BLOCKSKIP=   1.0 percent       # At the end of each block check if the previous
#                                 two blocks of cycles had similar damage (crack
#                                 extension) within this percentage.  If TRUE then
#                                 simply skip the simulation of the next block,
```

```
#                                but just add the expected damage.  Continue by
#                                simulating the block after the skip.
#                                A value of 0.0 will disallow skipping blocks.
#SAVELEVEL=  0               #Amount of output saved to disk:
#                           #   3=lots  2=medium  1=minimal
#                           #   0= save #crk=  data into binary direct access file only
#                           #      No #crk= data will be written into the text logfile.
#                           #      Use for large output files with lots of cycles.
```

Appendix 2: Print of da/dn vs DeltaK Table in file sm_dadn25CrMo4_S=+-100

```
   Delta_K        da/dN
0.4254730E+03  0.4022000E-07  0.2628872E+01 -0.7395558E+01  0.0000000E+00  0.0000000E+00     1
0.4444530E+03  0.2794740E-06  0.2647826E+01 -0.6553658E+01  0.1895404E-01  0.8418994E+00     2
0.4665970E+03  0.7302230E-06  0.2668942E+01 -0.6136545E+01  0.2111602E-01  0.4171138E+00     3
0.4924310E+03  0.1494050E-05  0.2692345E+01 -0.5825635E+01  0.2340341E-01  0.3109097E+00     4
0.5483020E+03  0.2850010E-05  0.2739020E+01 -0.5545154E+01  0.4667449E-01  0.2804813E+00     5
0.6071950E+03  0.4332370E-05  0.2783328E+01 -0.5363275E+01  0.4430842E-01  0.1818790E+00     6
0.7940460E+03  0.7975730E-05  0.2899846E+01 -0.5098229E+01  0.1165173E+00  0.2650452E+00     7
0.9685030E+03  0.1520900E-04  0.2986101E+01 -0.4817899E+01  0.8625531E-01  0.2803302E+00     8
0.1113510E+04  0.2155650E-04  0.3046694E+01 -0.4666422E+01  0.6059313E-01  0.1514773E+00     9
0.1246410E+04  0.3276720E-04  0.3095661E+01 -0.4484560E+01  0.4896688E-01  0.1818614E+00    10
0.1448530E+04  0.5157170E-04  0.3160928E+01 -0.4287589E+01  0.6526661E-01  0.1969719E+00    11
0.1638910E+04  0.8117580E-04  0.3214555E+01 -0.4090573E+01  0.5362749E-01  0.1970153E+00    12
0.1998980E+04  0.1521150E-03  0.3300808E+01 -0.3817828E+01  0.8625340E-01  0.2727454E+00    13
0.2373600E+04  0.2658390E-03  0.3375407E+01 -0.3575381E+01  0.7459903E-01  0.2424467E+00    14
```

Appendix 3: Print of Stress-Strain-Init.Life file: "matfile"

```
#SAE Standard Fatigue Data File format

# #
```

Pick one: #FDE_plot #FDE_fit # #

```
#
#Copyright (C) 2012  F.D.E. Committee
#This data file is free software - you can redistribute it and/or
#modify it under the terms of the GNU General Public License as
#published by the Free Software Foundation; either version 2 of the
#license, or (at your option) any later version.
#This data file is distributed in the hope that it will be useful,
#but WITHOUT ANY WARRANTY - without even the implied warranty of
#MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
#GNU General PUblic License for more details.
#You should have received a copy of the GNU General PUblic License
#along with this program - if not, write to the Free Software
#Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA
#Try also their web site: http://www.gnu.org/copyleft/gpl.html
#
# NOTE:  Fitted Data !!
# steel  30CrNiMo8  + 34CrNiMo6V merged file
# Files from Boller/Seeger,  Santera/Zenner, and Liebrich merged then fitted.

#FileType= strain_life
#DataType= fitted
```

```
#Strain_units= strain
#Stress_Units= MPa
#Name= 30CrNiMo8
#Name= 34CrNiMo6V
#Name= mergedFile
#Stress_units= mpa
#Strain_units= strain

#Sy= 787  # avg of 4 reported files.
#Su= 970  # average of 4 reported files.
#eu=  0.50   #strain at Su assume 1/2 of A5= 16 to 20%
#E= 206000 mpa  #rough average
#FractureStrain=  0.708
#FractureStress=  1168.  mpa

#FractureStrain=  0.708
#FractureStress=  1168.
#BHN= .  not reported
#%RA= 0. %

#The standard Coffin/Manson fit process worked well in this case.
#Monotonic Props.                    Cyclic Props.
#ELAS. MOD.= 29878. KSI,  206. GPA    K'        = 125.0 KSI,   862.MPA
#YIELD,0.2%=   114. KSI,  787. MPA    N'        = 0.0609
#ULT. STRG.=   141. KSI,  970. MPA    F. STRG COEF=  123.3 KSI,  850.MPA
#K       =      0.0 KSI,      0. MPA  F.STRG EXP, b=-0.0398
#N            = 0.0000                FAT DUCT COEF=   0.7949
#RED. IN AREA =  0.0                  F.DUCT EXP, c=-0.6534
#T. FRAC. STG.= 169.4 KSI, 1168. MPA  Exp Cyc Yld  =   86. Ksi, 590.MPA
#T. FRAC. STR.= 0.708                 Fit Cyc Yld  =   84. Ksi, 578.MPA
#No. fatigue data points=   49
#
#NOTE!! The Following Points are FITTED DATA:
#NOTE!! Fitted Stress computed using Experm. K' and n'
#TotalStrain    2Nf  Stress  Mean   Plastic Strain
#Amp                  Amp   Stress      Amp     Elastic Mod.
   0.79903          1  1081.4      0.   0.79378    206000. #Fitted_point
   0.01693        500   706.0      0.   0.01350    206000. #Fitted_point
   0.01185       1000   673.3      0.   0.00858    206000. #Fitted_point
   0.00859       2000   642.3      0.   0.00547    206000. #Fitted_point
   0.00598       5000   604.2      0.   0.00305    206000. #Fitted_point
   0.00480      10000   577.8      0.   0.00199    206000. #Fitted_point
   0.00401      20000   553.7      0.   0.00133    206000. #Fitted_point
   0.00336      50000   525.7      0.   0.00081    206000. #Fitted_point
   0.00304     100000   507.5      0.   0.00058    206000. #Fitted_point
   0.00281     200000   491.7      0.   0.00043    206000. #Fitted_point
   0.00260     500000   473.8      0.   0.00030    206000. #Fitted_point
   0.00248    1000000   462.0      0.   0.00023    206000. #Fitted_point
   0.00238    2000000   451.2      0.   0.00019    206000. #Fitted_point
   0.00227    5000000   438.0      0.   0.00014    206000. #Fitted_point
   0.00219   10000000   428.5      0.   0.00011    206000. #Fitted_point
   0.00213   20000000   419.2      0.   0.00009    206000. #Fitted_point
   0.00205   50000000   407.1      0.   0.00007    206000. #Fitted_point
#
#
```