

Results for sm_34CrNiMo6_S=+-100 : Crack Propagation Plate Edge Flaw

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Affiliation:

Sun May 25 14:20:32 EDT 2014

Simulation input data:

B= 10.0 mm

W= 24.0 mm

a₀= 3.0 mm

#MATERIAL= all_30-34CrNiMo+.html

#TYPE= plate_edge_flaw

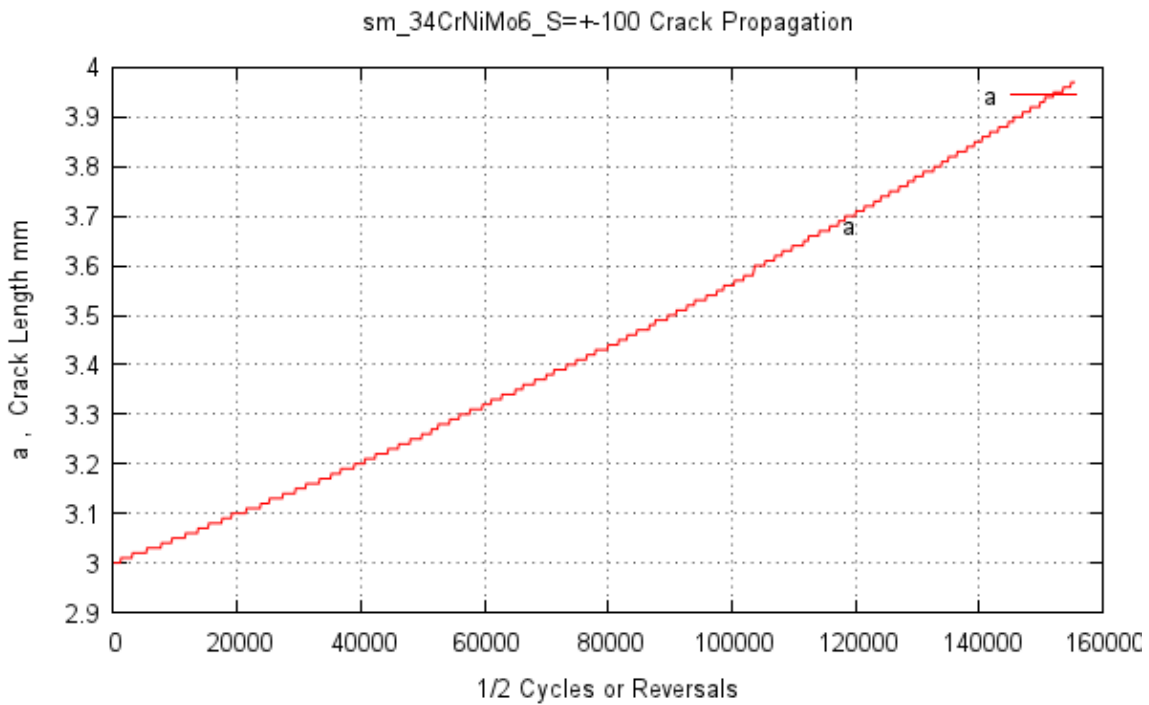
#ACTIVATE_MmMb= 1

M=Mkm=Mkb=fw=1.0

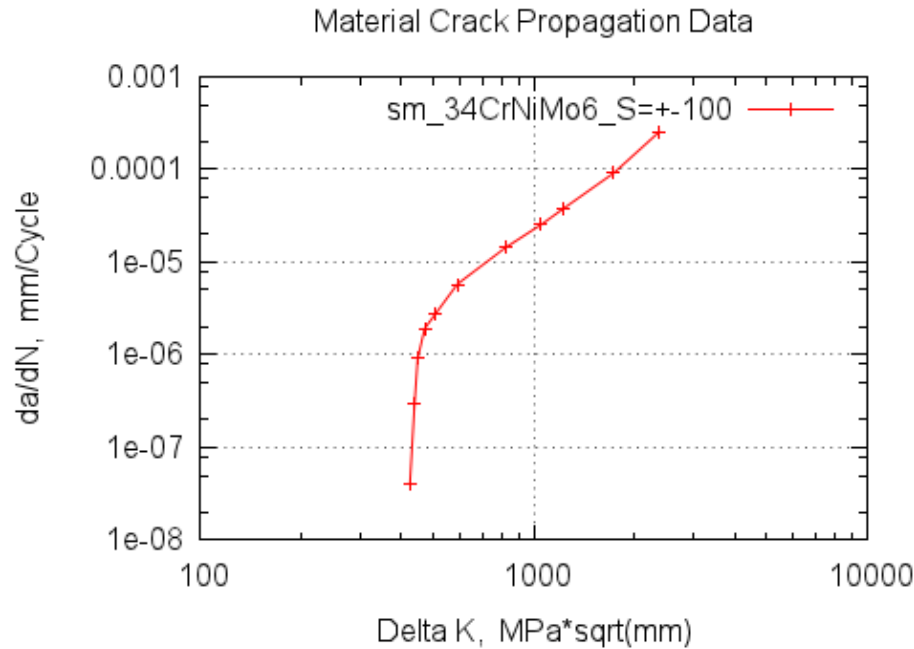
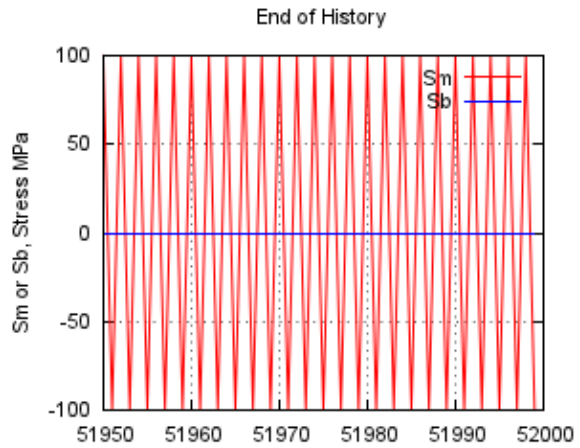
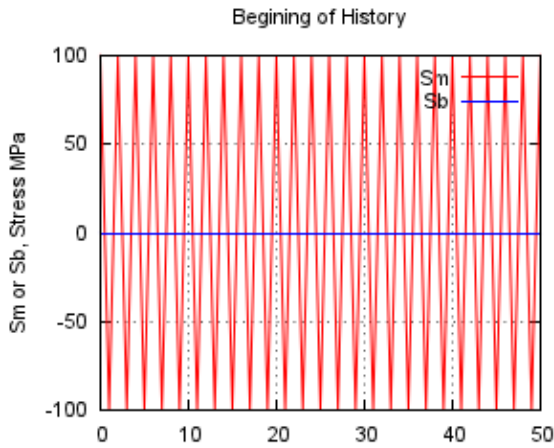
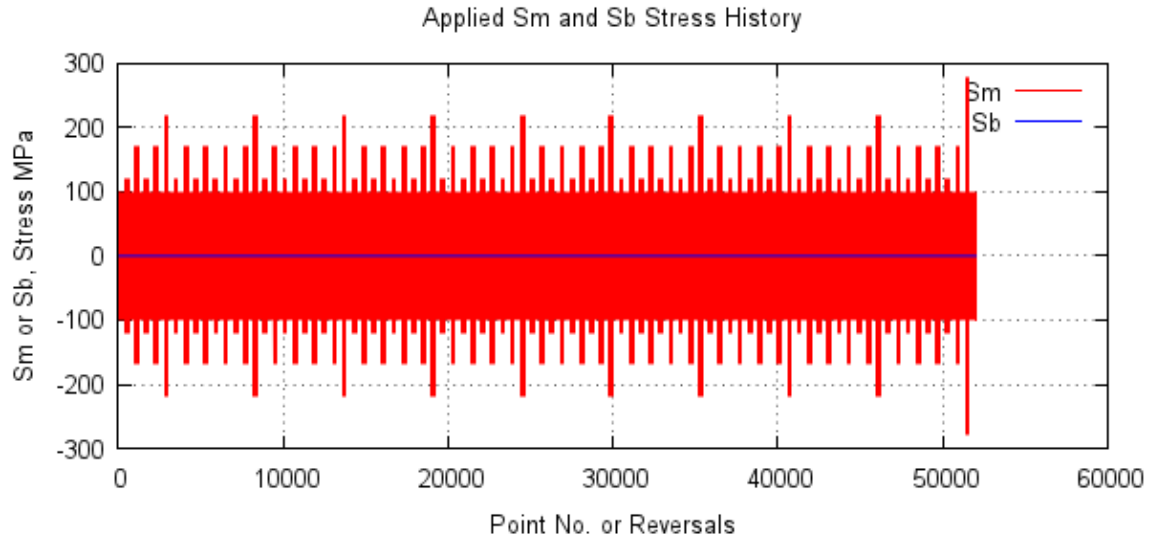
Crack Propagation Results:

(# plateEdgeFlaw.f vers. 3.11 # makereport5 vers. 2.1)

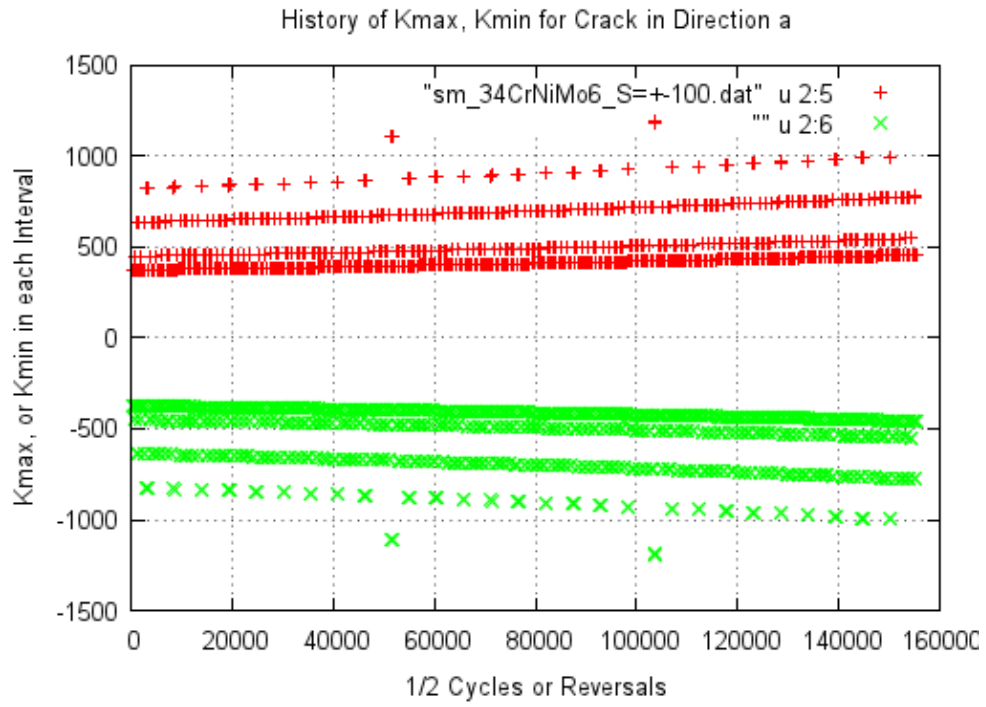
- No. of Reversals= 155376 revs. or 77688 cycles
- Final **a** = 0.397E+01 mm
- No. of History Reps.= 3 reps. + 51402 revs.



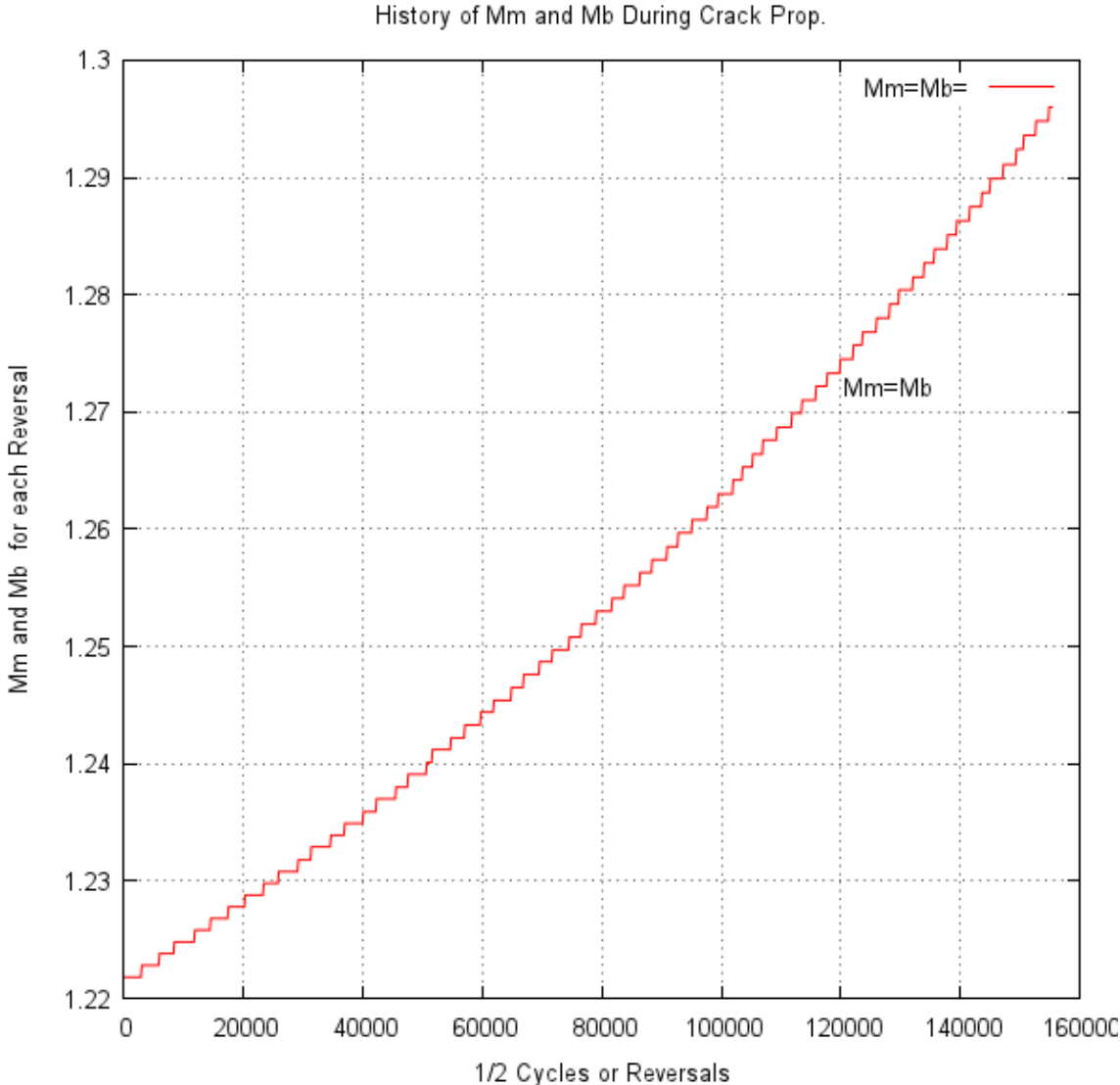
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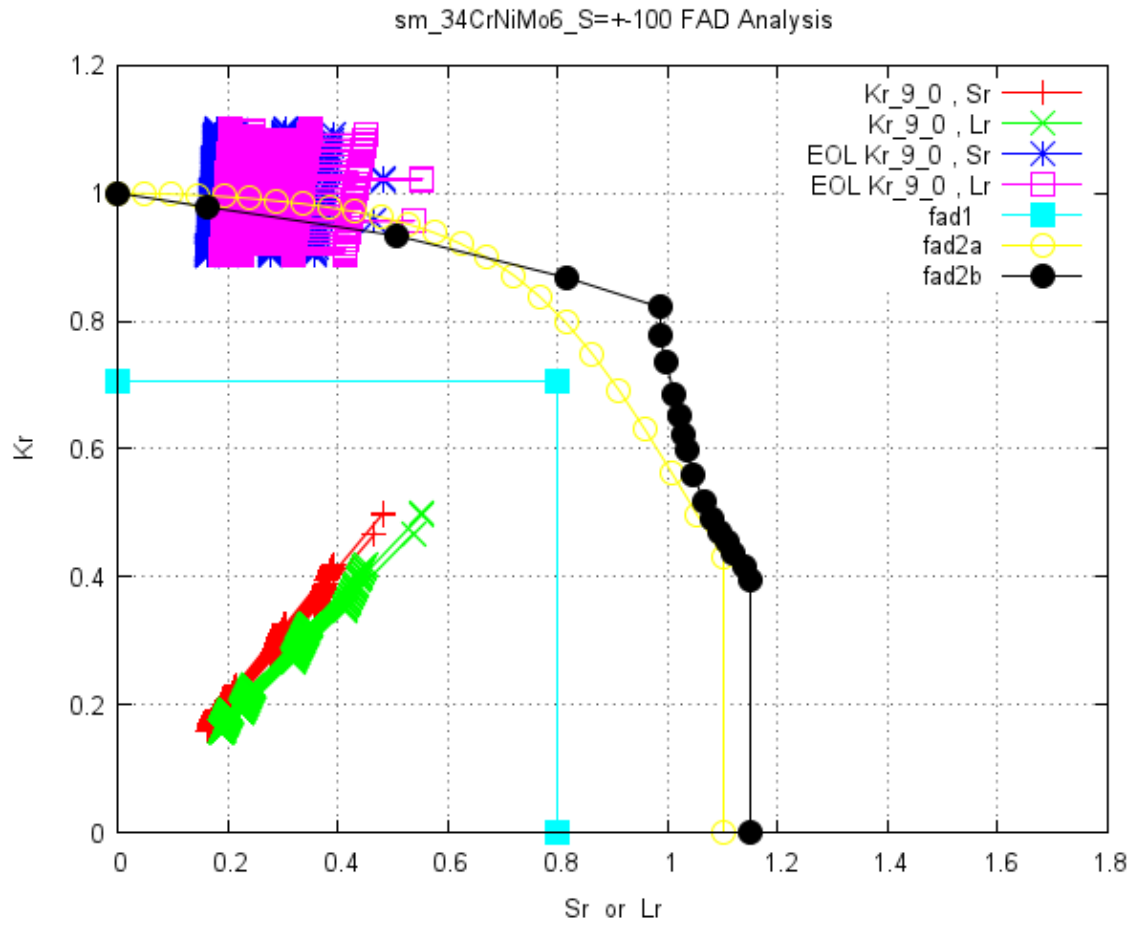


FAD Results for sm_34CrNiMo6_S=+-100

#TensileFile= boller_30CrNiMo8cylin_Tens.txt

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

plateEdgeFAD.f vers. 0.5



Crack Initiation Life Results for sm_34CrNiMo6_S=+-100 (Assume $K_t= 1.8$ for welds)

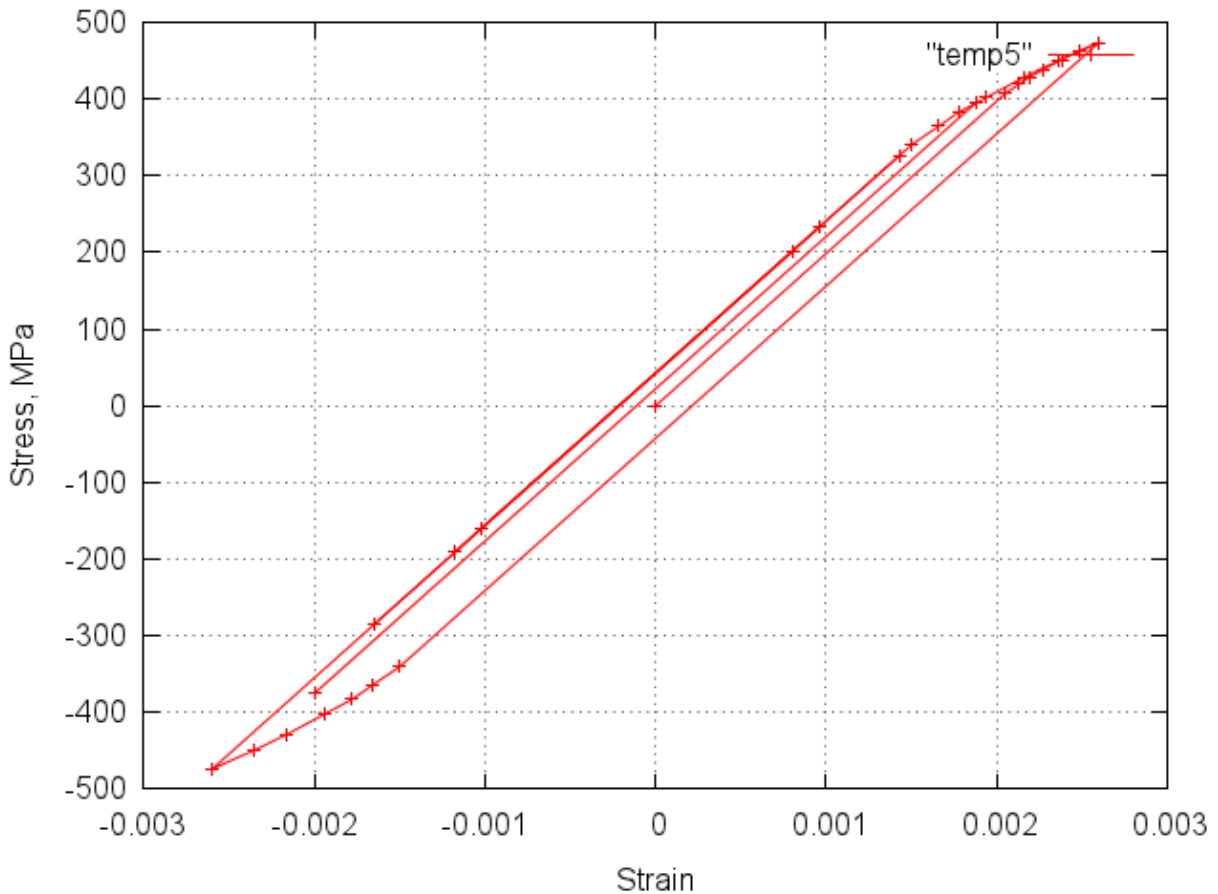
Files Used:

- [Stress History \(Sb+Sm\)](#)
- [Rainflow File](#)
- [Material File](#)

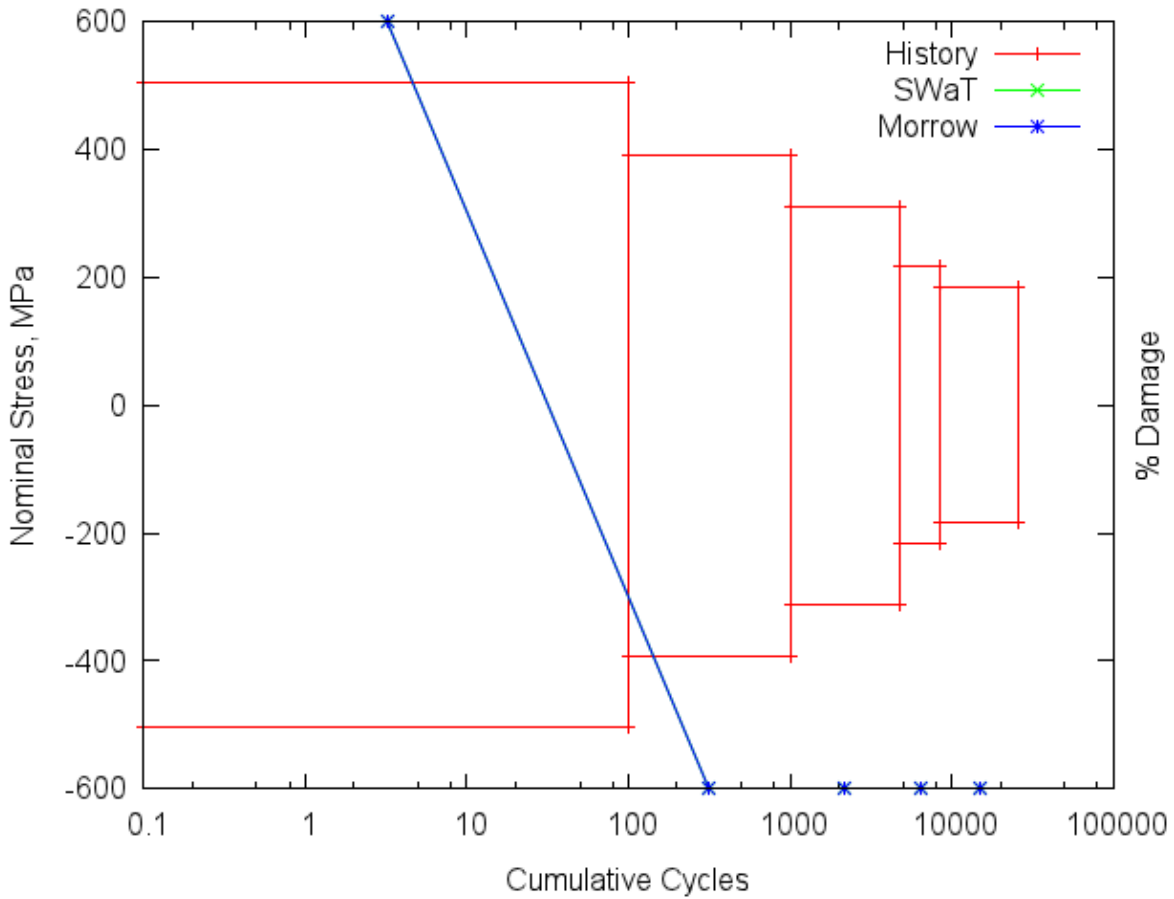
Predicted History Repetitions to Initiation:

StrainLife_Reps	SWaT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps (Reps= Repetitions)
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
```

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```

#                               # 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_34CrNiMo6_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= boiler_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,

```


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```
# 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_34CrNiMo6_S=+-100

Delta_K	da/dN						
0.4245290E+03	0.4063310E-07	0.2627907E+01	-0.7391120E+01	0.0000000E+00	0.0000000E+00		1
0.4383900E+03	0.3019850E-06	0.2641861E+01	-0.6520015E+01	0.1395345E-01	0.8711052E+00		2
0.4478810E+03	0.9061250E-06	0.2651163E+01	-0.6042812E+01	0.9301901E-02	0.4772029E+00		3
0.4699950E+03	0.1917730E-05	0.2672093E+01	-0.5717213E+01	0.2093053E-01	0.3255992E+00		4
0.5065840E+03	0.2764590E-05	0.2704652E+01	-0.5558369E+01	0.3255844E-01	0.1588435E+00		5
0.5885280E+03	0.5745400E-05	0.2769767E+01	-0.5240680E+01	0.6511545E-01	0.3176894E+00		6
0.8202640E+03	0.1419600E-04	0.2913954E+01	-0.4847834E+01	0.1441865E+00	0.3928456E+00		7
0.1049370E+04	0.2519740E-04	0.3020929E+01	-0.4598644E+01	0.1069751E+00	0.2491899E+00		8
0.1225670E+04	0.3759140E-04	0.3088374E+01	-0.4424911E+01	0.6744504E-01	0.1737328E+00		9
0.1735940E+04	0.9126550E-04	0.3239535E+01	-0.4039693E+01	0.1511610E+00	0.3852181E+00		10
0.2380920E+04	0.2548220E-03	0.3376745E+01	-0.3593763E+01	0.1372101E+00	0.4459302E+00		11

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
```

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```

#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 Exper. K' and n'
#TotalStrain  2Nf  Stress  Mean  Plastic Strain
#Amp
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
#
#

```