Results for ifpipeout1.0 : Crack Propagation Int. Pipe Surface Flaw

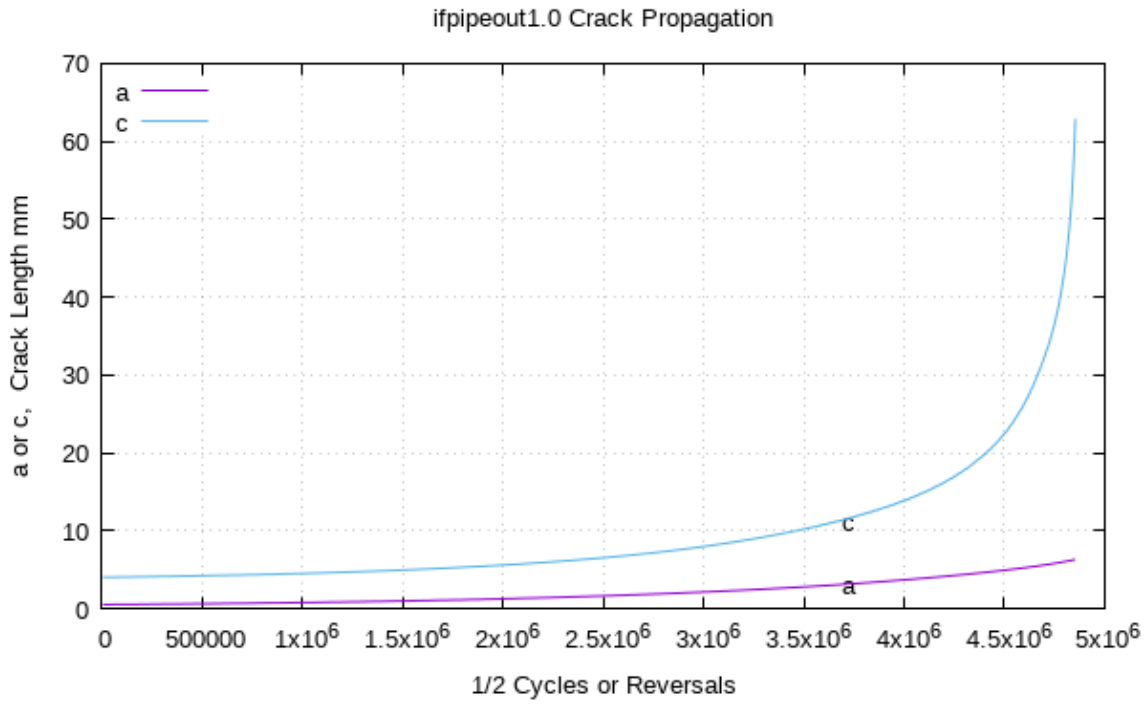
Author: edit file makereport3 to change
Affiliation:
Sat Jun 23 20:40:25 EDT 2018

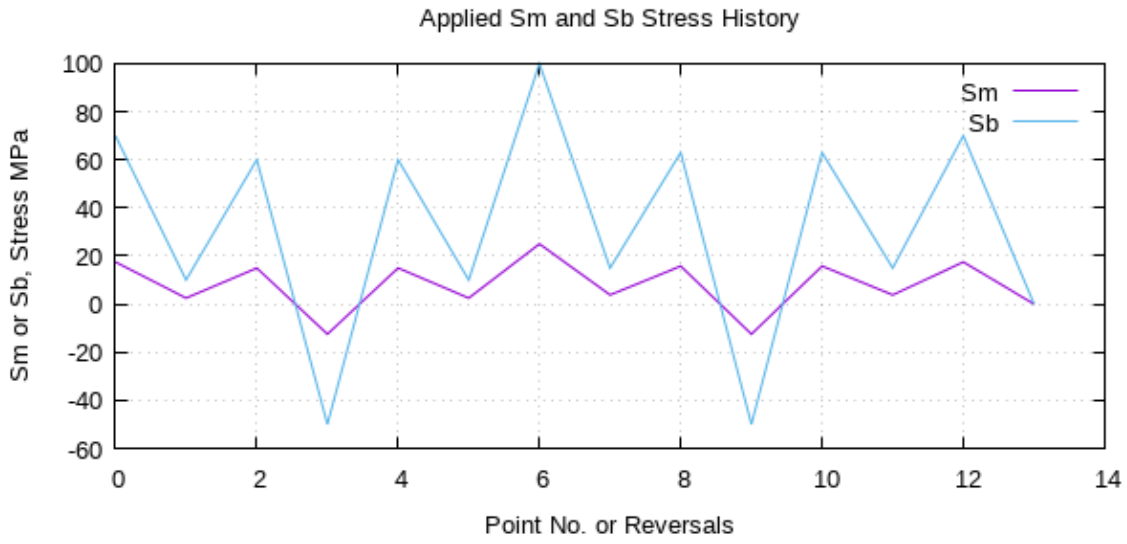
Simulation input data:
B= 10.0 mm
r_i= 50. mm
a_0= 0.5 mm
c_0= 4.0 mm

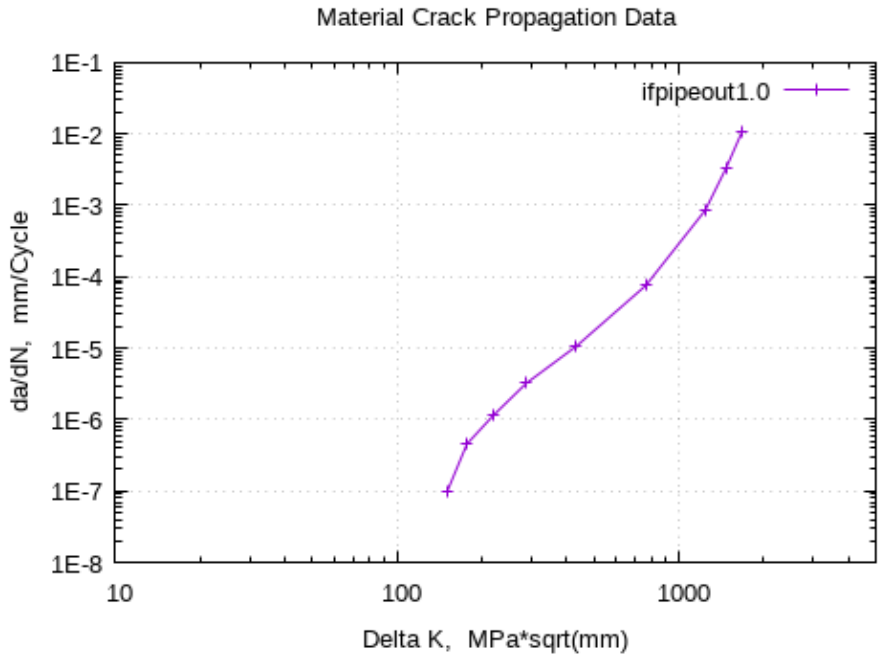
#MATERIAL= merged_a36_fitted.html
Kt= 2.0
#TYPE= pipe_inside_surface_flaw
#ACTIVATE_MmMb= 1 _____#ACTIVATE_MkmMkb= 0 _____#ACTIVATE_fw= 0

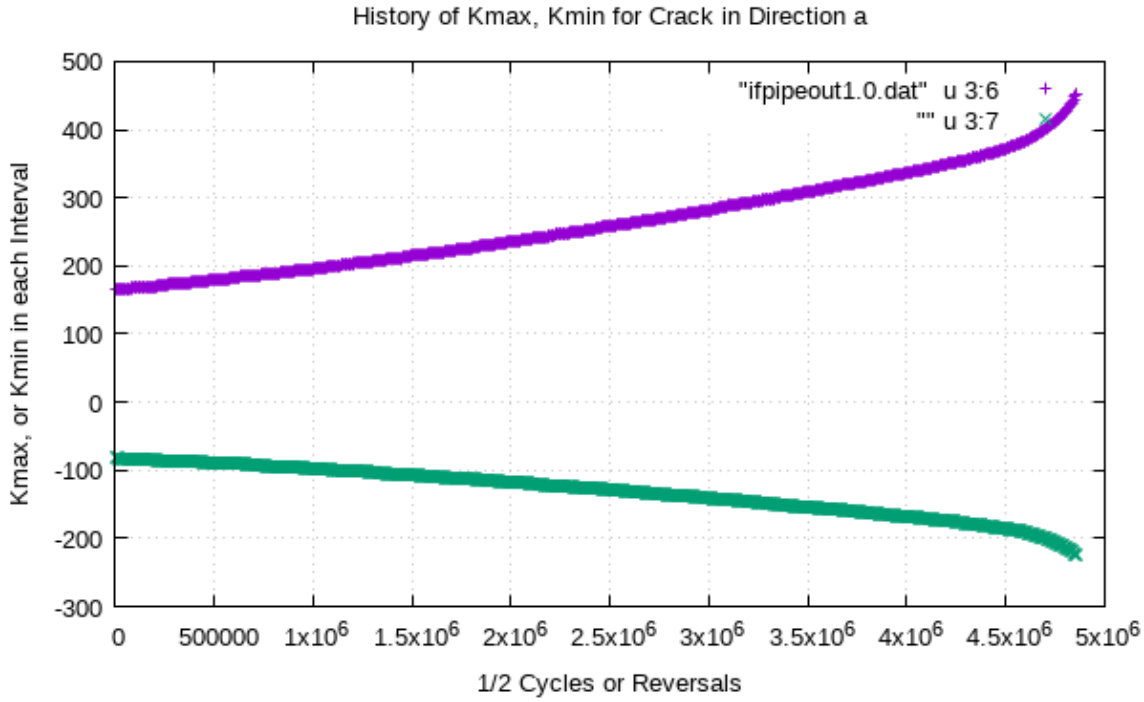
Crack Propagation Results:
(*# pipeIntSurfFlaw.f vers. 4.0 # makereport3 vers. 2.3*

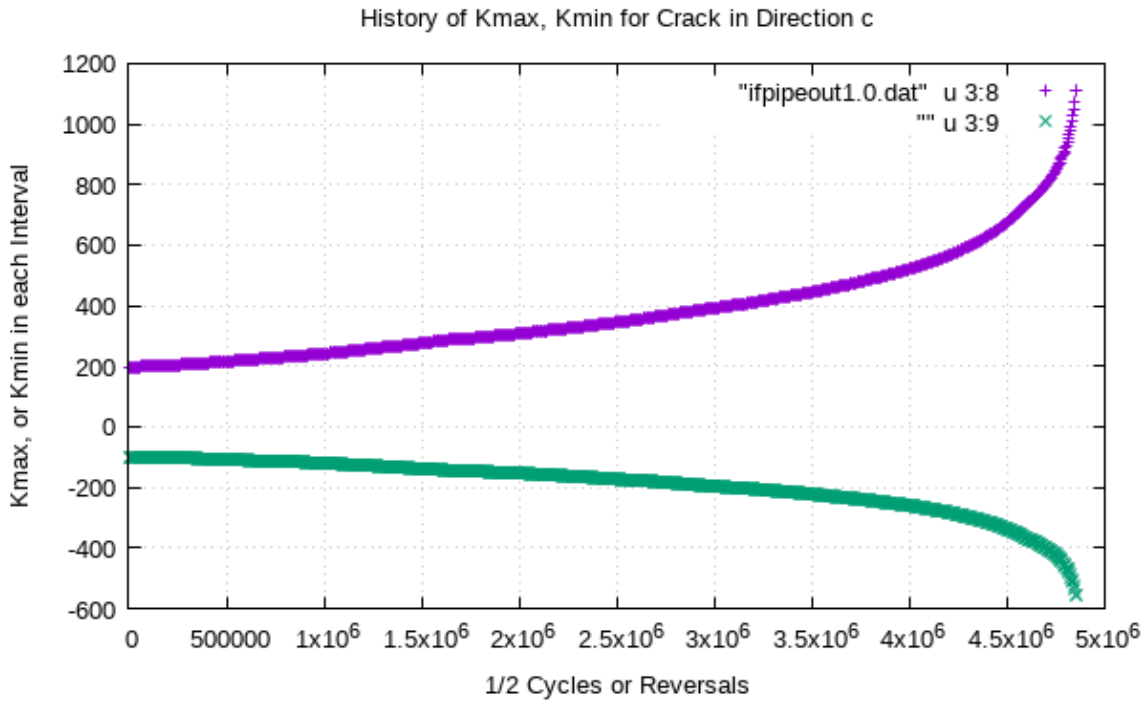
- No. of Reversals= 4853320 revs. or 2426660 cycles
- Final _____ **a** = 0.629E+01 mm
- Final _____ **c** = 0.629E+02 mm
- No. of History Reps.= 346666 reps. + 10 revs.
- No. records = 4853321 in random access data file

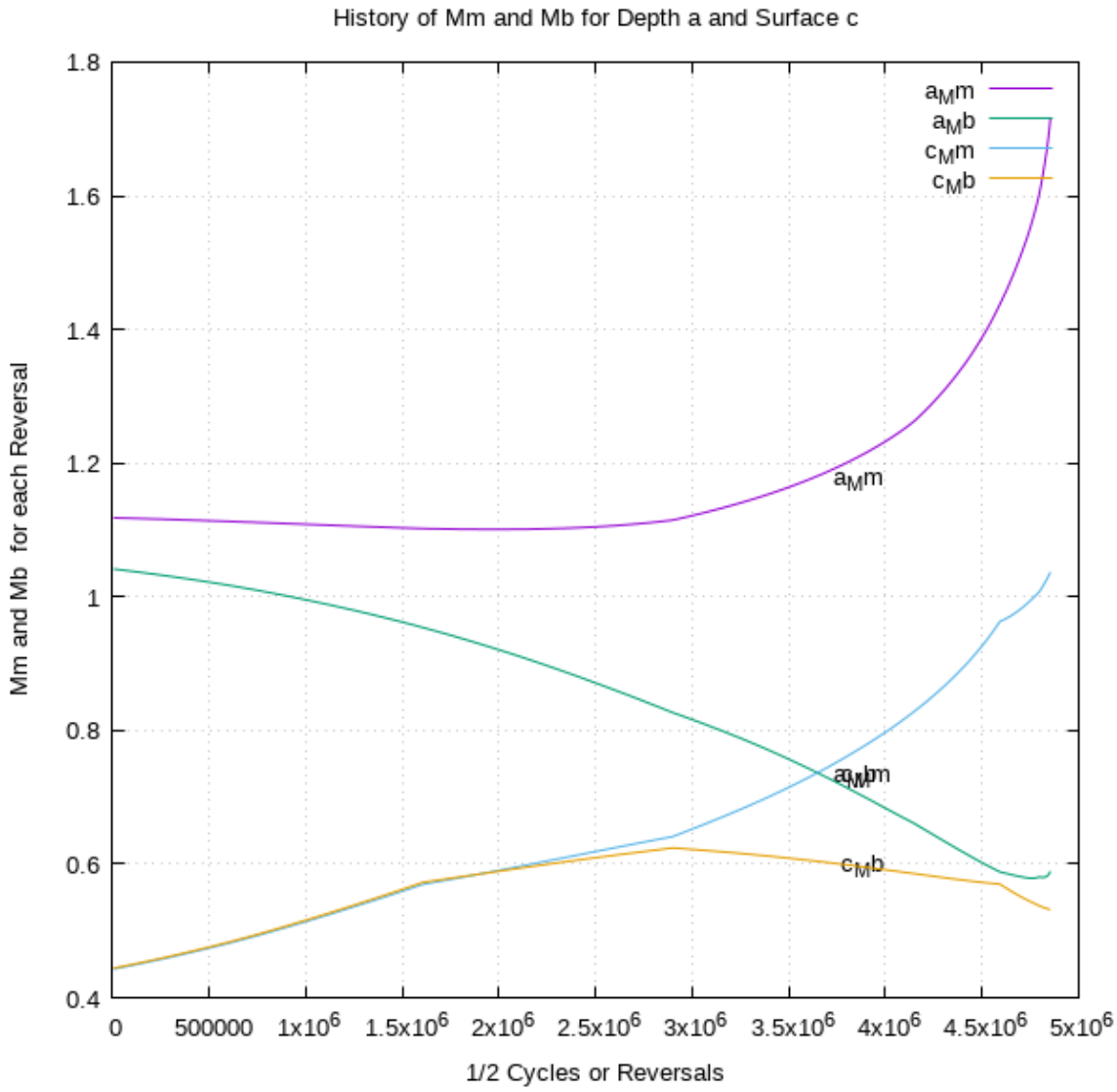



Applied Sm and Sb Stress History
Sm or Sb, Stress MPa
Point No. or Reversals
Sm
Sb
100
80
60
40
20
0
-20
-40
-60
0
2
4
6
8
10
12
14


Material Crack Propagation Data
da/dN, mm/Cycle
Delta K, MPa*sqrt(mm)
ifpipeout1.0
1E-1
1E-2
1E-3
1E-4
1E-5
1E-6
1E-7
1E-8
10
100
1000

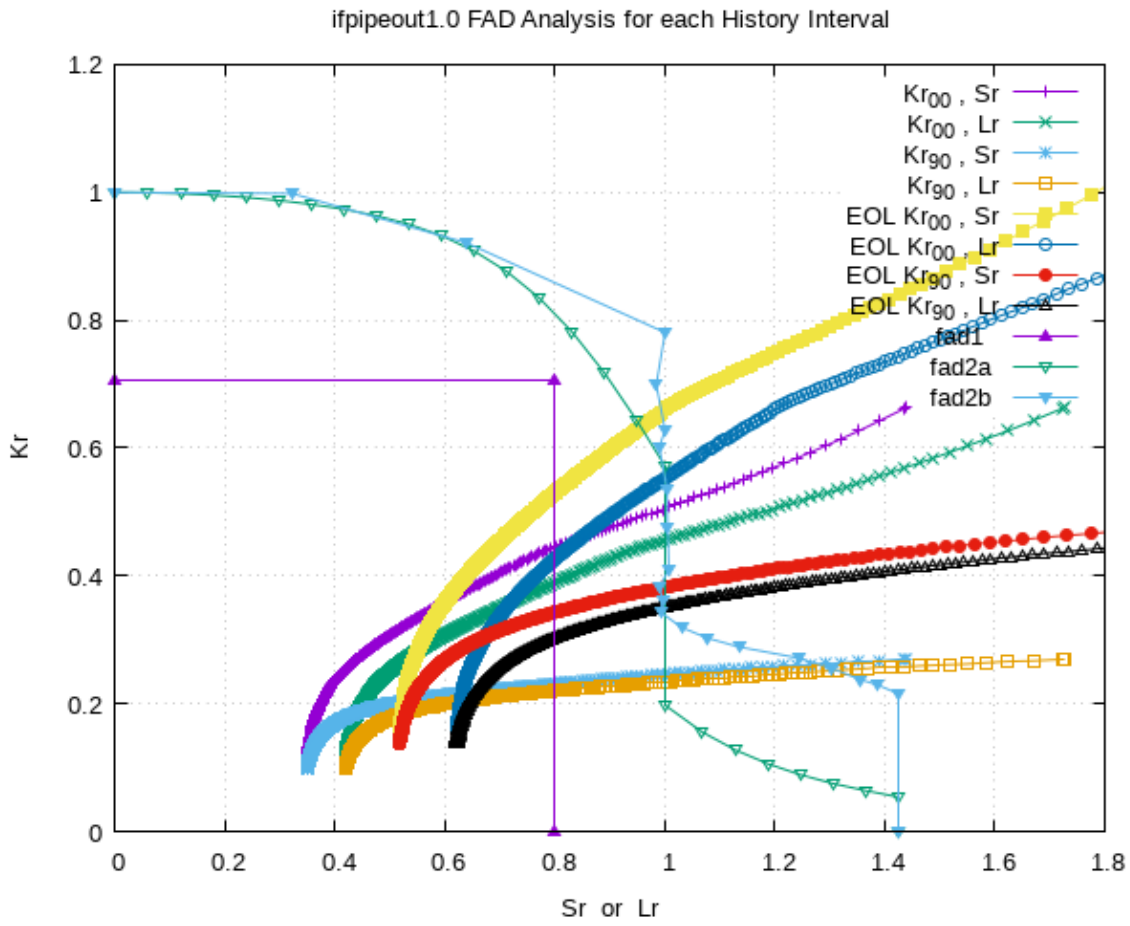

History of Kmax, Kmin for Crack in Direction a
"ifpipeout1.0.dat" u 3:6
"" u 3:7
Kmax, or Kmin in each Interval
1/2 Cycles or Reversals
500
400
300
200
100
0
-100
-200
-300
0
500000
1x10^6
1.5x10^6
2x10^6
2.5x10^6
3x10^6
3.5x10^6
4x10^6
4.5x10^6
5x10^6


History of Kmax, Kmin for Crack in Direction c
"ifpipeout1.0.dat" u 3:8
"" u 3:9
Kmax, or Kmin in each Interval
1/2 Cycles or Reversals
1200
1000
800
600
400
200
0
-200
-400
-600
0
500000
1x10^6
1.5x10^6
2x10^6
2.5x10^6
3x10^6
3.5x10^6
4x10^6
4.5x10^6
5x10^6


History of Mm and Mb for Depth a and Surface c
Mm and Mb for each Reversal
1/2 Cycles or Reversals
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0
500000
1x10^6
1.5x10^6
2x10^6
2.5x10^6
3x10^6
3.5x10^6
4x10^6
4.5x10^6
5x10^6
aMm
aMb
cMm
cMb

FAD Results for ifpipeout1.0 #TensileFile= a36_Mattos_mono_engrSS_FLAT.txt

#PmEOL= 70. #PbEOL= 100.
#Kmat= 1675.



Crack Initiation Life Results for ifpipeout1.0 (Using Kt= 2.0)

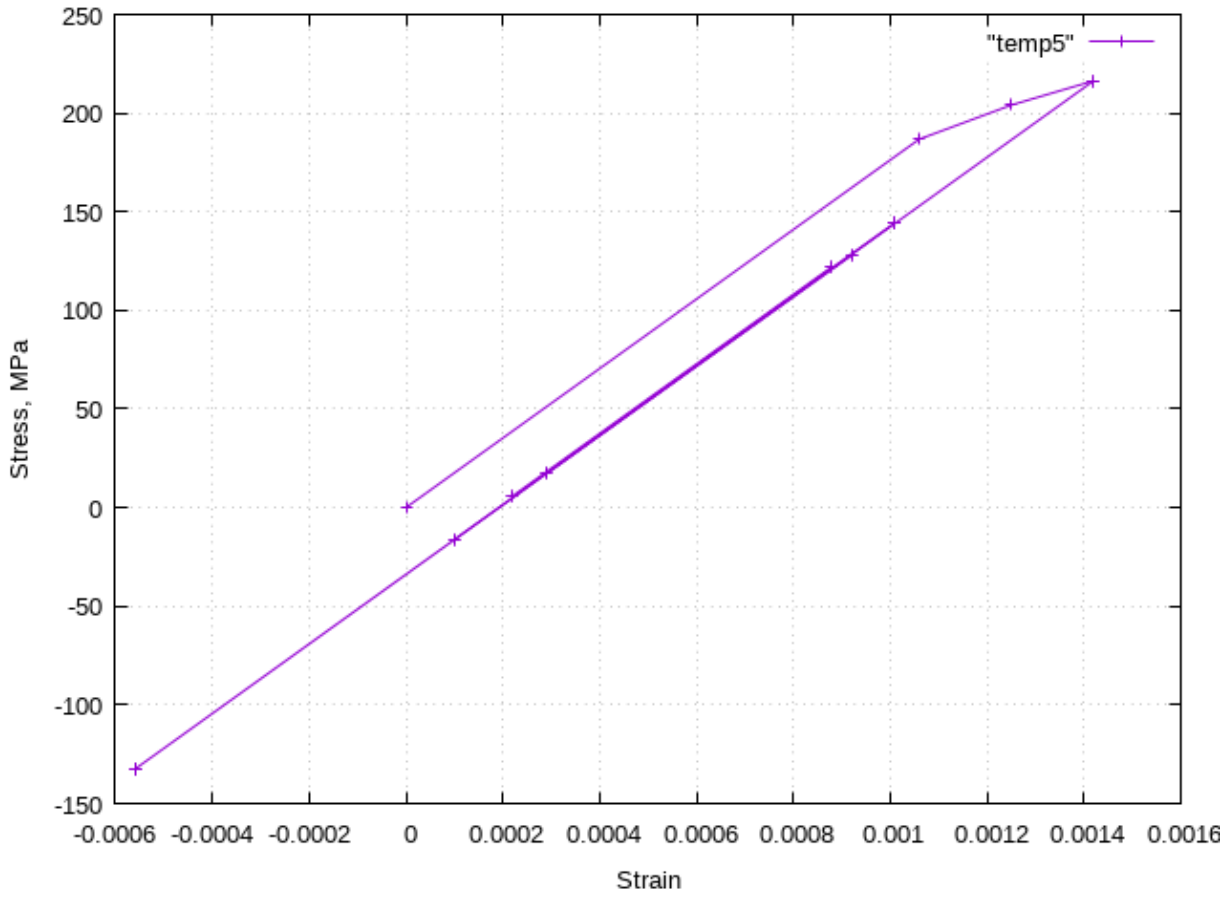
Files Used:

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

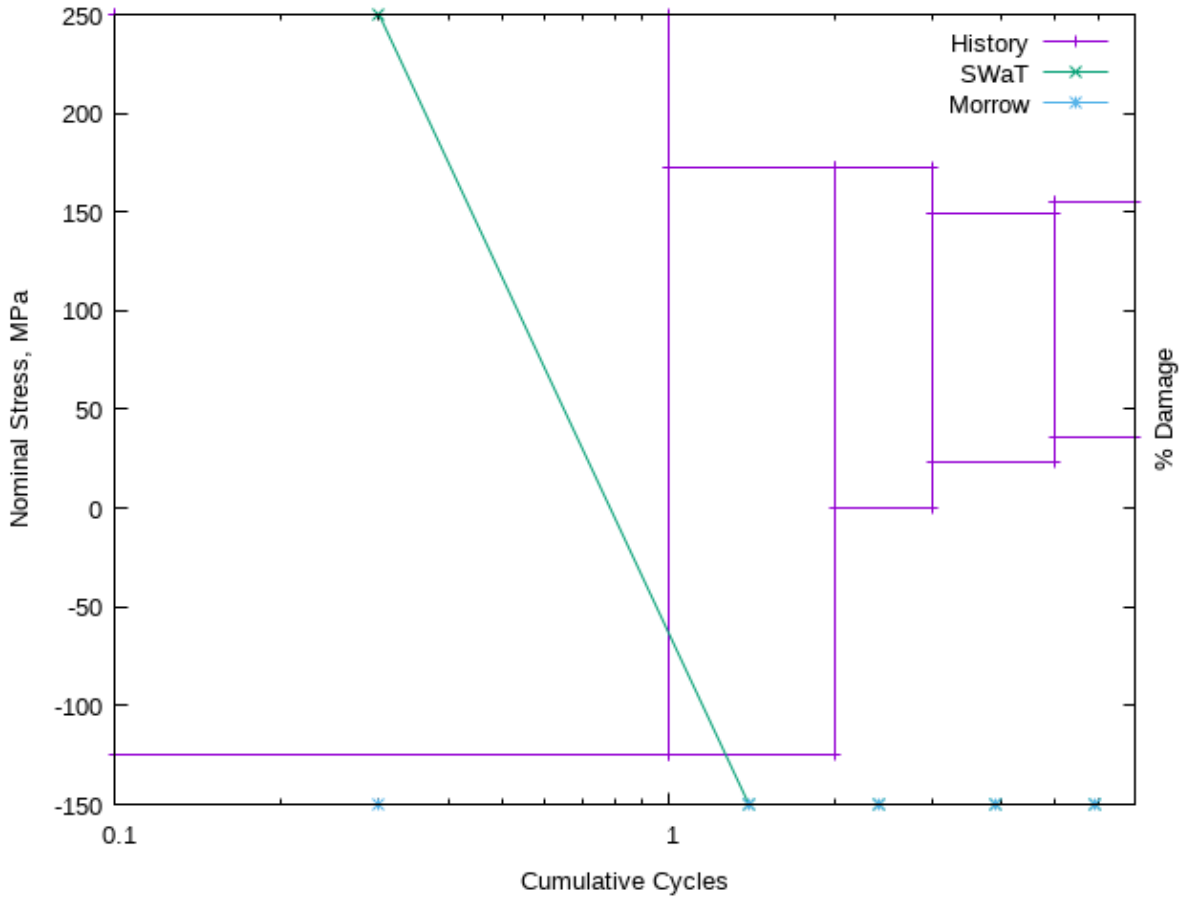
Predicted History Repetitions to Initiation:

StrainLife_Reps	SWT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps	(Reps= Repetio
Infinity	1883637.1	Infinity	Infinity	Infinity	

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	%SWT	%St
1	250.0	-125.0	1.0	216.	-133.	349.	0.00142	-.00056	0.00198	0.0	100.0	0.0
2	172.6	-125.0	1.0	144.	-133.	277.	0.00101	-.00056	0.00157	0.0	0.0	0.0
3	172.6	0.0	1.0	144.	-16.	161.	0.00101	0.00010	0.00091	0.0	0.0	0.0
4	148.8	23.8	2.0	122.	6.	116.	0.00088	0.00022	0.00066	0.0	0.0	0.0
5	154.8	35.8	2.0	128.	17.	111.	0.00092	0.00029	0.00063	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= pipe_inside_surface_flaw     #with or without weld using ACTIVATEs:
#ACTIVATE_MmMb=     1    #  Deactivate  = 0
#ACTIVATE_MkmMkb=   0    #  Set to off for inside surf. flaw.( not available )
#ACTIVATE_fw=       0    #  Set to off for inside surf. flaw.( fw=1.0 )

#                              #Other      #TYPE=  options:
```

```
#                                # plate_surface_flaw
#                                # plate_long_surface_flaw
#                                # plate_tru_flaw
#                                # plate_embedded_flaw
#                                # plate_edge_flaw
#                                #
#                                # pipe_inside_surface_flaw
#                                # pipe_long_inside_surface_flaw
#                                # pipe_full_inside_flaw
#                                # pipe_full_outside_flaw
#                                #
#                                # rod_surface_flaw
#                                # rod_full_outside_flaw

#                                # These problem types are used to pull in the
#                                # 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=  0.0   # plate width
#ri= 50.    # Internal diameter if pipe problem
#azero= 0.5  # initial crack depth
#czero= 4.0  # initial 1/2 crack width at surface
#L= 0.      # Weld Feature width.  Set to 0.0 if no Mkm or Mkb (weld)

#HISTORYFILE=  load1.txt    # historyFileName
#           # 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.
#                     # Normally this would be some large number.
#
#MATERIAL=  merged_a36_fitted.html   #File name of material fitted data
#                                    This file is used to define the cyclic
#                                    stress-strain curve, and the Neuber Product curve.
#Kt= 2.0              #Stress Conc. Factor, presently for crack init. calcs only
#
#DADN= table                       # Can be "table" or "Paris"
#DADN_PARIS= 0.0 0.0 0.0 0.0 mpa_mm    # Kth  a  m  Kc units (ignored if #DADN= table )
#                                !! specify:   mpa_m   or   ksi_in  or  mpa_mm
#                                ksi_in: ksi stress, inch crack length, inches in delta_K
#                                mpa_m:  mpa stress,    m crack length, meters in delta_K
#                                mpa_mm: mpa stress,   mm crack length, mm in delta_K
#                                        same as N/(mm**(3/2))
#DADN_TABLE= a36+1015.dadn    # 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=  a36_Mattos_mono_engrSS_FLAT.txt     #enter "none"  if no FAD
```

```
#PmEOL= 70.              #Set these so that Pm+Pb= 0.82*Syield for default.
#PbEOL= 100.
#Kmat= 1675.
#PinJoint= 0                #Set = 1 if struture is pinJointed (for bending)
#
#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 ifpipeout1.0

Delta_K	da/dN				
0.1502160E+03	0.9620540E-07	0.2176716E+01	-0.7016800E+01	0.0000000E+00	0.0000000E+00
0.1769830E+03	0.4562300E-06	0.2247931E+01	-0.6340816E+01	0.7121515E-01	0.6759844E+00
0.2202350E+03	0.1160170E-05	0.2342886E+01	-0.5935478E+01	0.9495497E-01	0.4053378E+00
0.2874840E+03	0.3224090E-05	0.2458614E+01	-0.5491593E+01	0.1157272E+00	0.4438853E+00
0.4331670E+03	0.1069760E-04	0.2636655E+01	-0.4970714E+01	0.1780417E+00	0.5208793E+00
0.7637410E+03	0.7556810E-04	0.2882946E+01	-0.4121662E+01	0.2462907E+00	0.8490520E+00
0.1240590E+04	0.8520410E-03	0.3093628E+01	-0.3069540E+01	0.2106822E+00	0.1052122E+01
0.1471680E+04	0.3307300E-02	0.3167813E+01	-0.2480526E+01	0.7418513E-01	0.5890131E+00
0.1675690E+04	0.1074680E-01	0.3224194E+01	-0.1968721E+01	0.5638027E-01	0.5118057E+00

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 !!
# A36 Steel Merged Data Sets from Refs. 1 and 2:
```

```
# Ref.1: P.Dindinger report to Fat.Des.+Eval. Comm. Apr.2012
# Ref.2: G.A.Miller and H.S.Reemsnyder, "Strain-Cycle Fatigue of Sheet and
# Plate Steels I:  Test Method Development and Data Presentation,"
# SAE Paper 830175, Detroit MI, Feb28-Mar.4, 1983
#
# NOTE that original test data ends at  2Nf = 1.3million.
#
#FileType= strain_life
#DataType= fitted
#TIMEcol= 0
#NAME=  ASTM-A36
#NAME=  Structural
#NAME=  Steel
#Stress_units= ksi
#Strain_units= strain
#Sy=    38.4 0.2pc offset, 265  mpa
#Su=  69.  ksi from Miller/Reemsnyder = 475 mpa
#eu=       0   #strain at Su not reported
#E= 29528. ksi  = 203600 mpa
#FractureStrain=  0 not reported
#FractureStress=  0. not reported
#monotonic_K= 0  not reported
#monotonic_n= 0  not reported
#BHN= 138.
#%RA= 0. %  not reported
#
#saedigcurve_v2.2.f starts.
# NOTE!! The Following Points are FITTED DATA:#NOTE!! Fitted Stress computed using E
# Total Strain   2Nf  Stress  Mean   Plastic Strain   Initial
#    Amp               Amp   Stress      Amp        Elastic Mod.
   0.88485          1   115.3      0.   0.88095     29528. #Fitted_point
   0.00914       5000    52.1      0.   0.00737     29528. #Fitted_point
   0.00665      10000    48.8      0.   0.00499     29528. #Fitted_point
   0.00493      20000    45.7      0.   0.00338     29528. #Fitted_point
   0.00344      50000    42.0      0.   0.00202     29528. #Fitted_point
   0.00270     100000    39.3      0.   0.00136     29528. #Fitted_point
   0.00217     200000    36.8      0.   0.00092     29528. #Fitted_point
   0.00169     500000    33.8      0.   0.00055     29528. #Fitted_point
   0.00144    1000000    31.6      0.   0.00037     29528. #Fitted_point
#Original test data ends at  2Nf = 1.3million.
#Points below are extrapolation:
   0.00125    2000000    29.6      0.   0.00025     29528. #Fitted_point
   0.00106    5000000    27.1      0.   0.00014     29528. #Fitted_point
#
#
```