Results for eg.ifpipeout2.0 : Crack Propagation Int. Pipe Surface Flaw

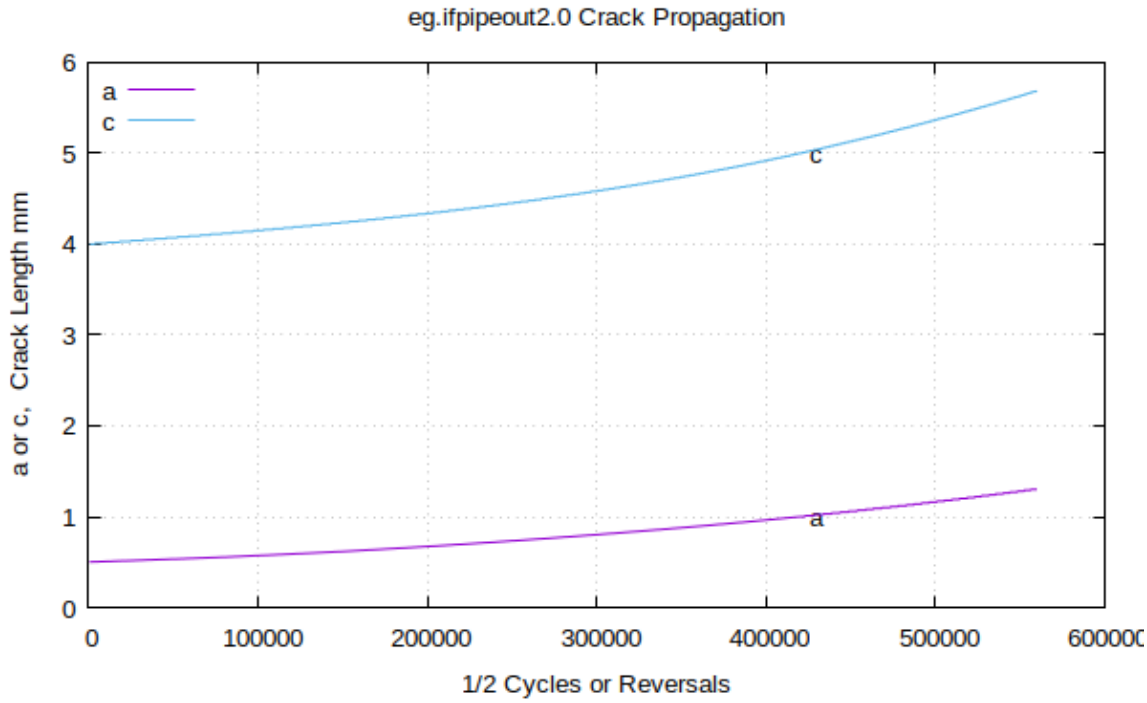
Author: edit file makereport3 to change
Affiliation:
Wed Jul 1 17:34:55 EDT 2020

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
#Kmat= 1675.

Crack Propagation Results:
(*# pipeIntSurfFlaw.f vers. 5.2 June2020 # makereport3 vers. 2.6*

- No. of Reversals= 560001 revs. or 280000 cycles
- Final _____ **a** = 0.130E+01 mm
- Final _____ **c** = 0.569E+01 mm
- No. of History Reps.= 40001 reps. + 1 revs.
- No. records = 840051 in random access data file



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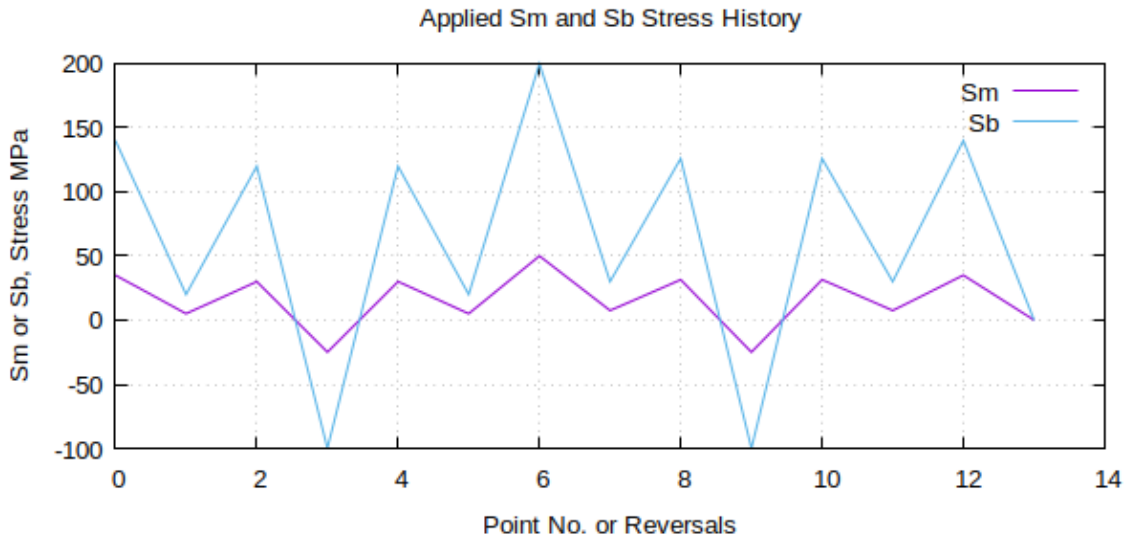
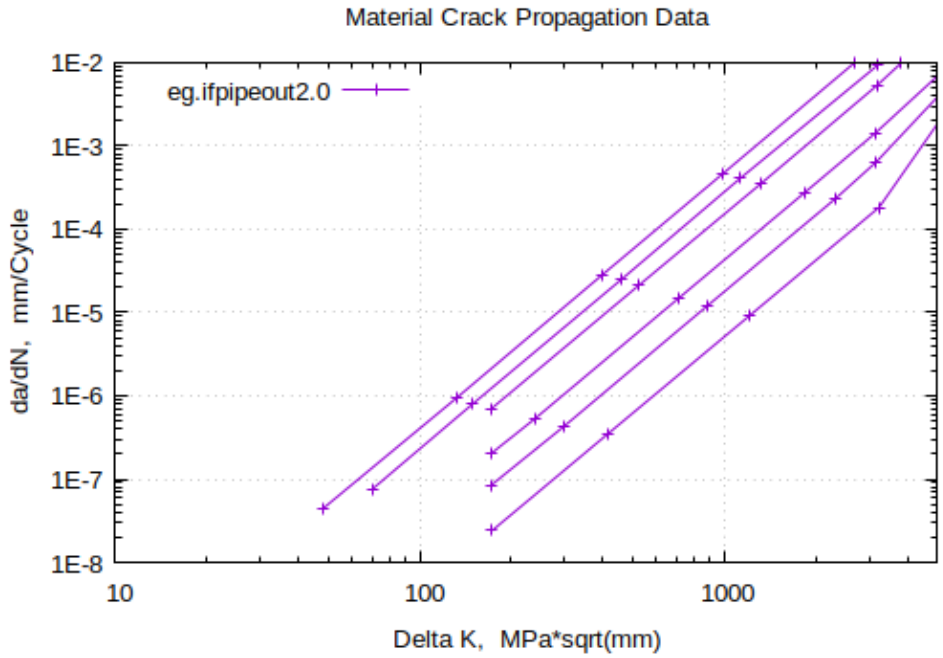
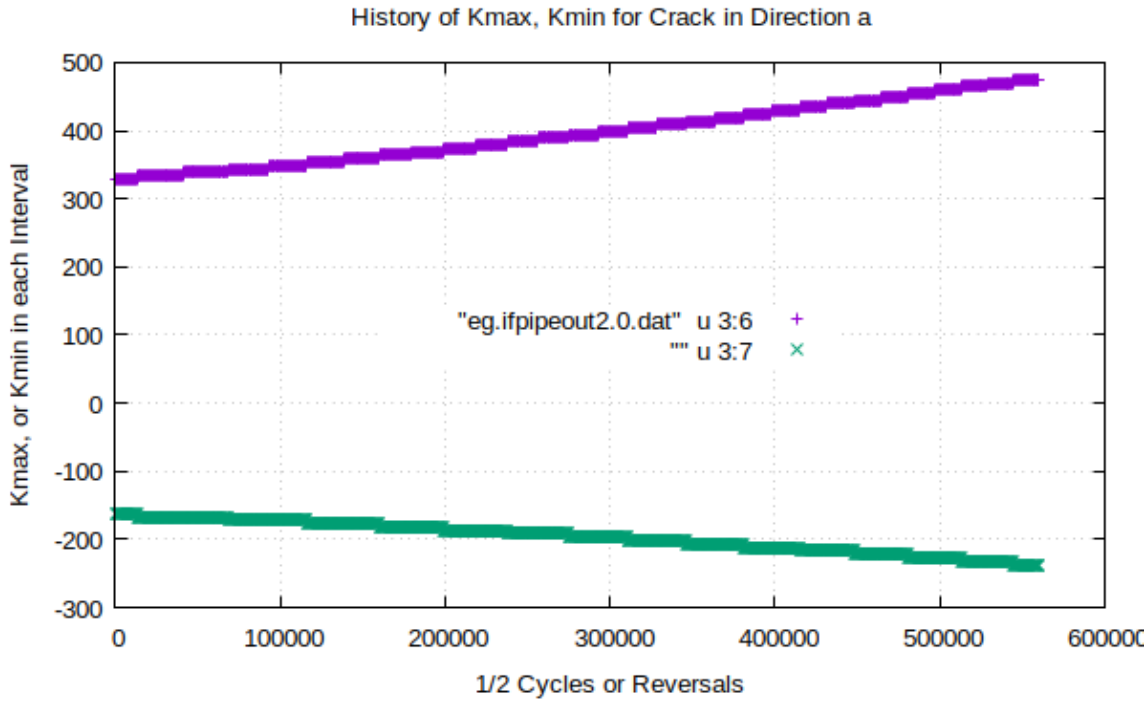
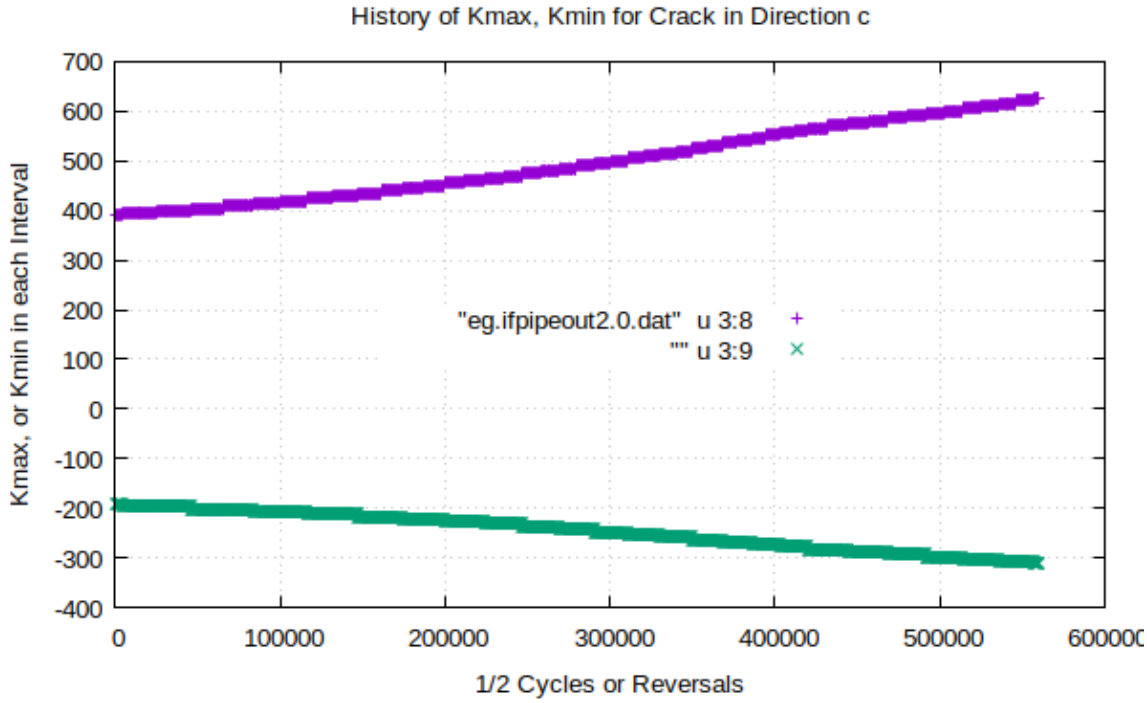
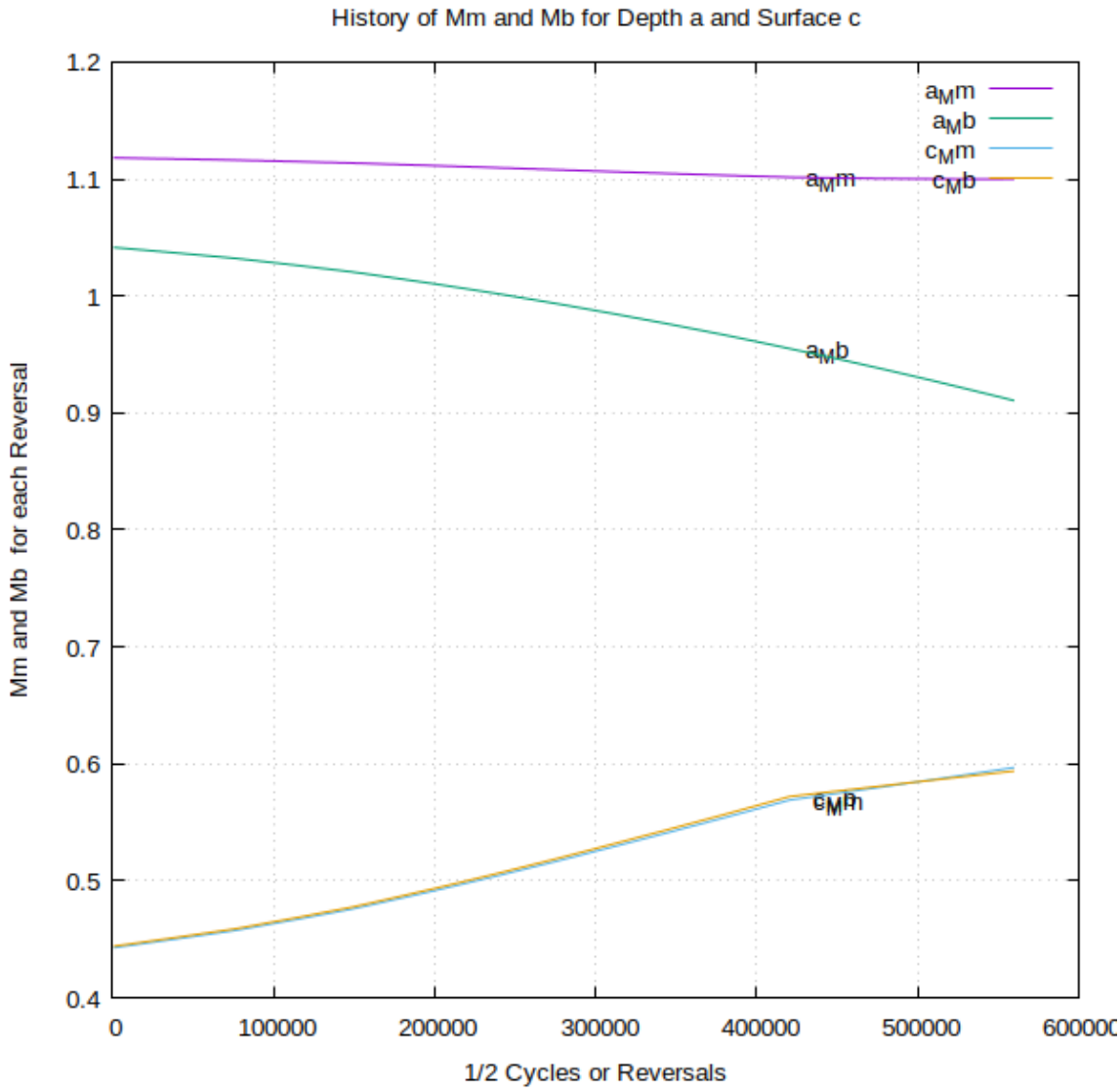




#DADN= ASME1994 # Can be "table" or "Paris" "USER" BS7910
#DADN_PARIS= 0. 0. 0. 0. mpa_mm
#DADN_TABLE= none # da/dN digitized da/dN curve for material,

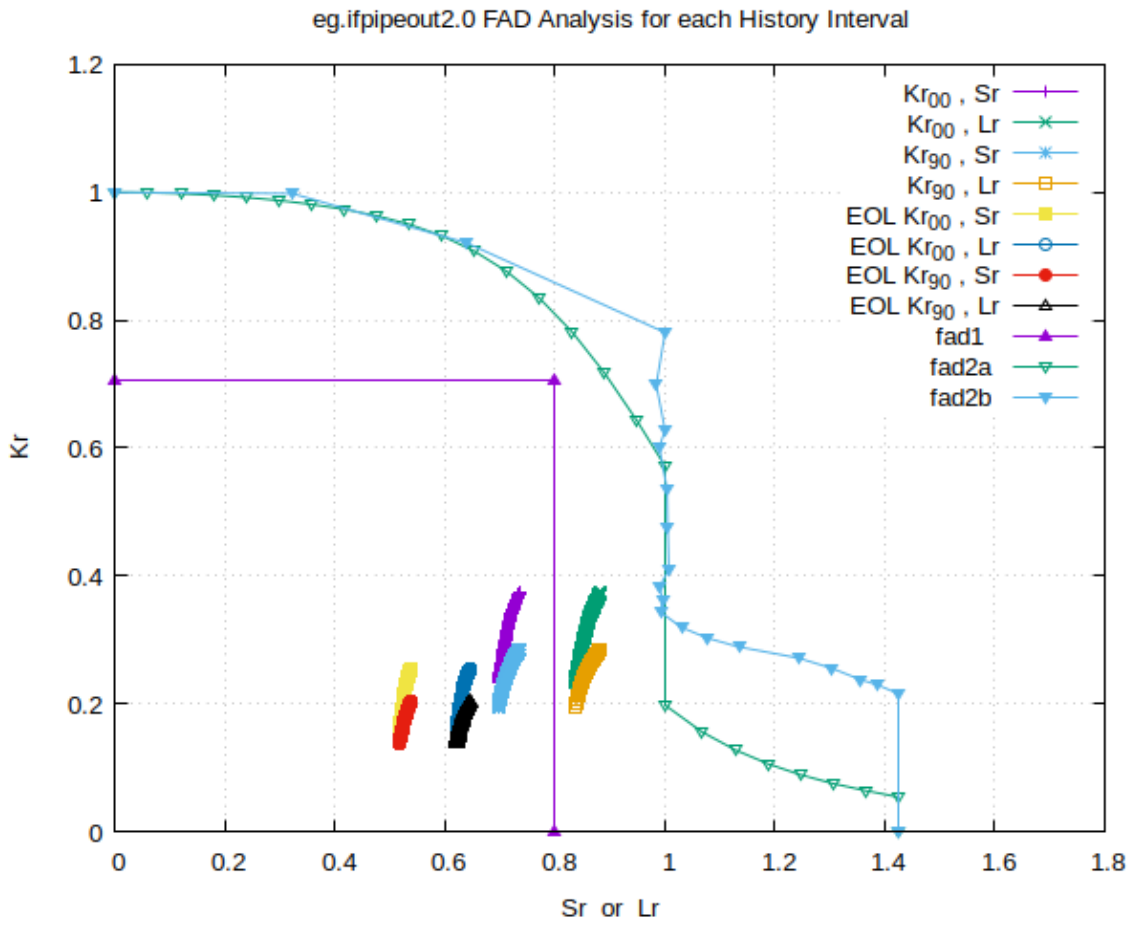





History of Mm and Mb for Depth a and Surface c
Mm and Mb for each Reversal
1/2 Cycles or Reversals
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0
100000
200000
300000
400000
500000
600000
aMm
aMb
cMm
cMb

FAD Results for eg.ifpipeout2.0 #TensileFile= a36_Mattos_mono_engrSS_FLAT.txt

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



Crack Initiation Life Results for eg.ifpipeout2.0 (Using Kt= 2.0)

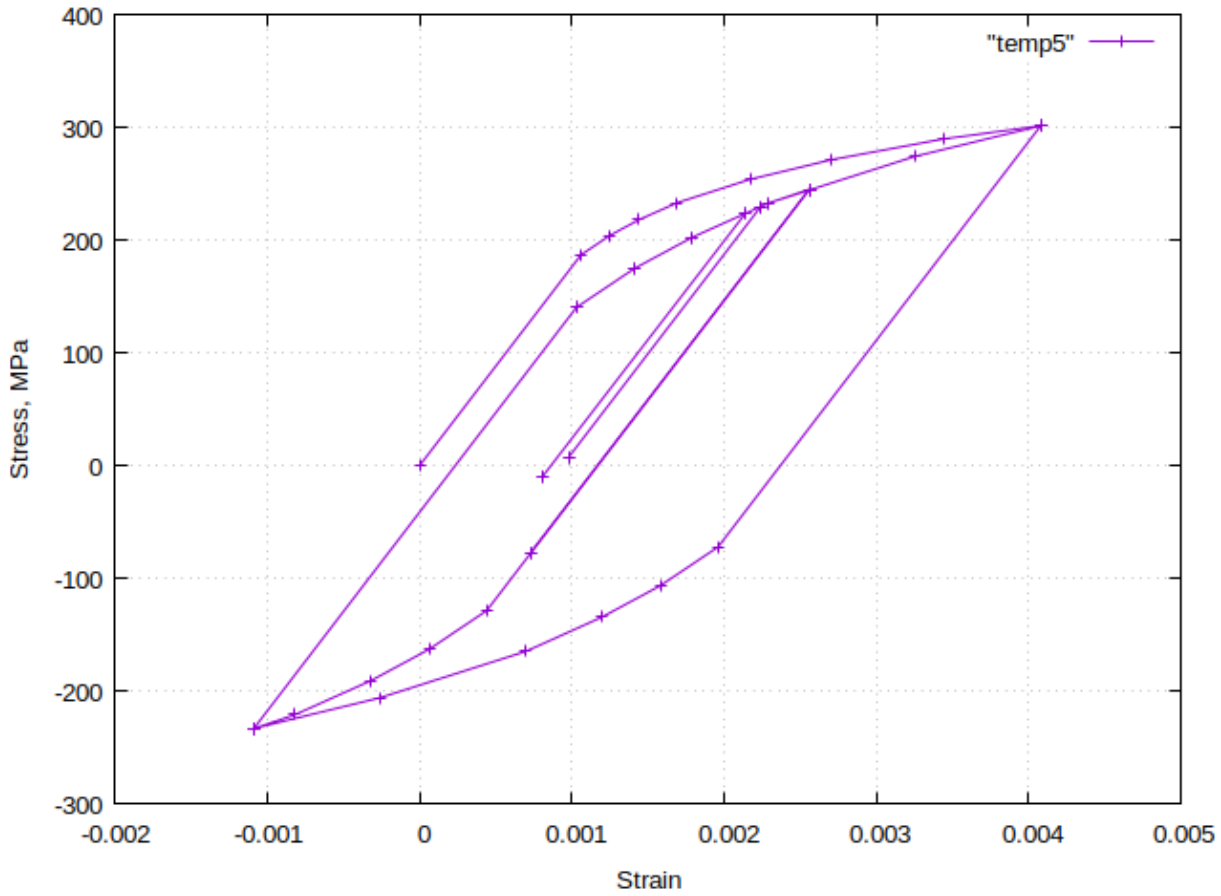
Files Used:

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

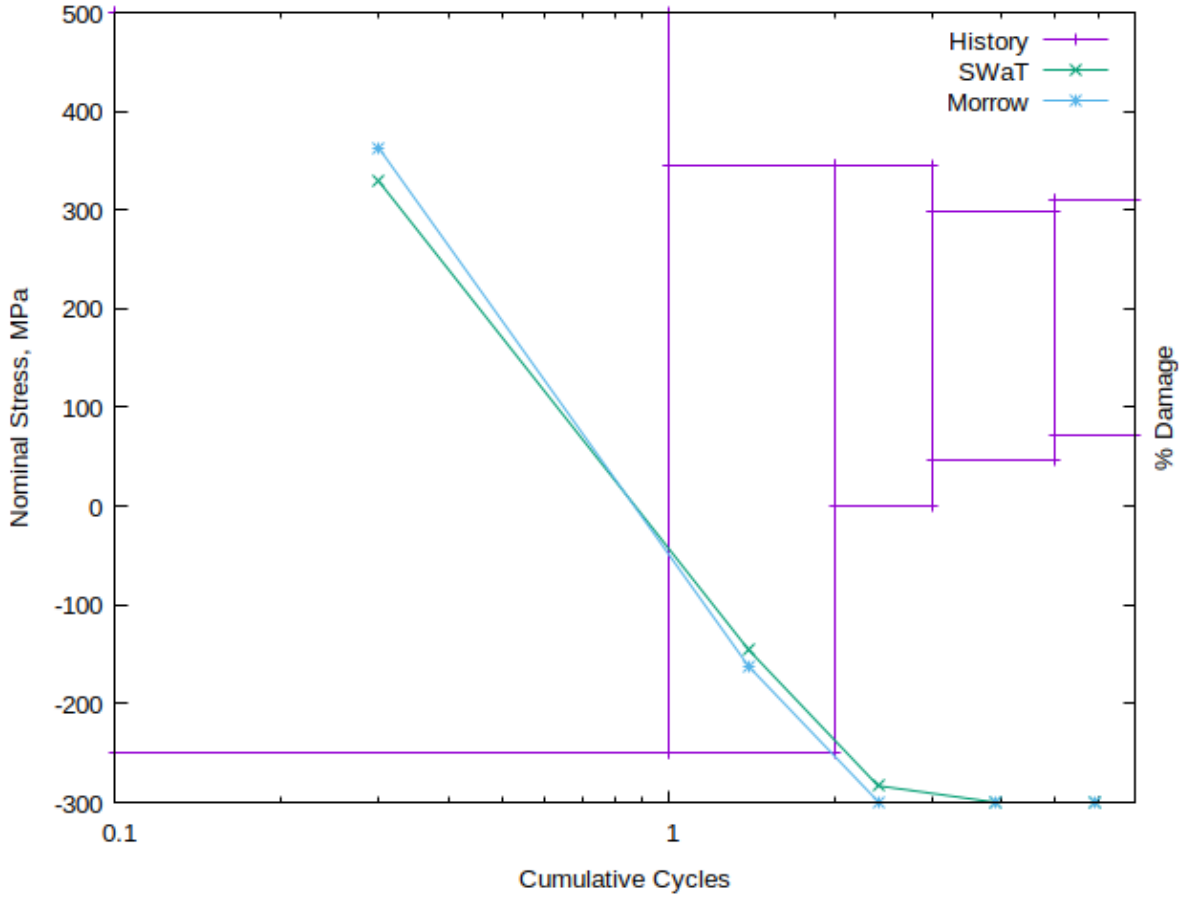
Predicted History Repetitions to Initiation:

StrainLife_Reps	SWT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps	(Reps= Repetio
44105.2	34187.0	44105.3	30154.8	22551.4	

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	500.0	-250.0	1.0	301.	-233.	535.	0.00408	-.00109	0.00517	76.7	78.6	76.7
2	346.0	-250.0	1.0	245.	-233.	478.	0.00256	-.00109	0.00365	23.3	19.3	23.3
3	346.0	0.0	1.0	245.	-77.	322.	0.00256	0.00073	0.00183	0.0	2.1	0.0
4	298.0	47.6	2.0	224.	-9.	233.	0.00214	0.00081	0.00132	0.0	0.0	0.0
5	310.0	71.4	2.0	230.	8.	222.	0.00224	0.00098	0.00126	0.0	0.0	0.0

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

```
# Vers. 5.0  Jul 2020 Allows multiple dadn files/curves.

# 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=   40000     # 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              # Ktg gross. The history is in gross stress for cracks.
#                     #Stress Conc. Factor, presently for crack init. calcs only
#
#DADN= ASME1994             # Can be "table" or "Paris" "USER" BS7910
#                           # HASEGAWA2019, HASEGAWA2016 or ASME1994
#                           # If "table" only one dadn file is expected
#                           # and it is specified by #DADN_TABLE= filename below.
#                           # If "USER" copy your prepared dadn files into
#                           # filenames: dadnTable01, dadnTable02, dadnTable03, etc.
#
#DADNFileNum= 1              # With "USER" only: no. of dadn files or curves
#                            # (ignored if NOT "USER" above.)
#                            # Run "setup1" when changing this.
#
#DADN_PARIS= 0.   0.  0.  0.  mpa_mm
#          # Kth  a   m   Kc  units     (ignored if #DADN not Paris )
#                              !! 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= none             # 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= not table )
#
#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.               # KIc See BS7910 Sec. 7.1.5 for details. Used for Fracture.
#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 eg.ifpipeout2.0

```
   Delta_K        da/dN

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  1 R=  -2.00
0.1729261E+03  0.2404800E-07  0.2237861E+01 -0.7618921E+01  0.0000000E+00  0.0000000E+00
0.4135313E+03  0.3444500E-06  0.2616508E+01 -0.6462874E+01  0.3786478E+00  0.1156047E+01
0.1214695E+04  0.9184000E-05  0.3084467E+01 -0.5036968E+01  0.4679587E+00  0.1425906E+01
0.3233779E+04  0.1829500E-03  0.3509710E+01 -0.3737668E+01  0.4252431E+00  0.1299301E+01
0.1010100E+05  0.6410000E-02  0.4004364E+01 -0.2193142E+01  0.4946542E+00  0.1544526E+01

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  2 R=  -1.00
0.1720000E+03  0.8473000E-07  0.2235528E+01 -0.7071963E+01  0.0000000E+00  0.0000000E+00
0.2997083E+03  0.4375100E-06  0.2476699E+01 -0.6359012E+01  0.2411704E+00  0.7129507E+00
0.8843000E+03  0.1212200E-04  0.2946600E+01 -0.4916426E+01  0.4699008E+00  0.1442586E+01
0.2322853E+04  0.2323800E-03  0.3366022E+01 -0.3633801E+01  0.4194219E+00  0.1282624E+01
0.3162280E+04  0.6400000E-03  0.3500000E+01 -0.3193820E+01  0.1339786E+00  0.4399812E+00
0.7071491E+04  0.7335000E-02  0.3849511E+01 -0.2134600E+01  0.3495107E+00  0.1059220E+01

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  3 R=  -0.50
0.1720000E+03  0.2033500E-06  0.2235528E+01 -0.6691756E+01  0.0000000E+00  0.0000000E+00
0.2396692E+03  0.5346000E-06  0.2379612E+01 -0.6271971E+01  0.1440837E+00  0.4197845E+00
0.7103113E+03  0.1492500E-04  0.2851449E+01 -0.4826086E+01  0.4718366E+00  0.1445886E+01
0.1840985E+04  0.2753700E-03  0.3265050E+01 -0.3560083E+01  0.4136014E+00  0.1266002E+01
0.3134136E+04  0.1411000E-02  0.3496118E+01 -0.2850473E+01  0.2310677E+00  0.7096105E+00
0.5505213E+04  0.8238000E-02  0.3740774E+01 -0.2084178E+01  0.2446563E+00  0.7662947E+00

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  4 R=   0.00
0.1720000E+03  0.7002000E-06  0.2235528E+01 -0.6154778E+01  0.0000000E+00  0.0000000E+00
0.5241163E+03  0.2110800E-04  0.2719428E+01 -0.4675553E+01  0.4838991E+00  0.1479225E+01
0.1328316E+04  0.3579200E-03  0.3123302E+01 -0.3446214E+01  0.4038739E+00  0.1229339E+01
0.3190677E+04  0.5368300E-02  0.3503883E+01 -0.2270163E+01  0.3805814E+00  0.1176051E+01
0.3798531E+04  0.9690000E-02  0.3579616E+01 -0.2013676E+01  0.7573271E-01  0.2564871E+00

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  5 R=   0.50
0.7000000E+02  0.7633000E-07  0.1845098E+01 -0.7117305E+01  0.0000000E+00  0.0000000E+00
0.1485418E+03  0.7861000E-06  0.2171849E+01 -0.6104522E+01  0.3267508E+00  0.1012783E+01
0.4583093E+03  0.2462300E-04  0.2661159E+01 -0.4608659E+01  0.4893098E+00  0.1495863E+01
0.1130831E+04  0.4080500E-03  0.3053398E+01 -0.3389287E+01  0.3922391E+00  0.1219373E+01
0.3219359E+04  0.9476000E-02  0.3507769E+01 -0.2023375E+01  0.4543717E+00  0.1365911E+01

#deltK dadn logdeltaK logdadn logdiffdk logdiffdadn  File=  6 R=   0.90
0.4835759E+02  0.4498600E-07  0.1684465E+01 -0.7346923E+01  0.0000000E+00  0.0000000E+00
0.1316489E+03  0.9312000E-06  0.2119417E+01 -0.6030957E+01  0.4349525E+00  0.1315966E+01
0.3989849E+03  0.2850500E-04  0.2600956E+01 -0.4545079E+01  0.4815392E+00  0.1485878E+01
0.9888766E+03  0.4616100E-03  0.2995142E+01 -0.3335725E+01  0.3941855E+00  0.1209354E+01
0.2680127E+04  0.9929000E-02  0.3428155E+01 -0.2003094E+01  0.4330134E+00  0.1332630E+01
```

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
#
#
```