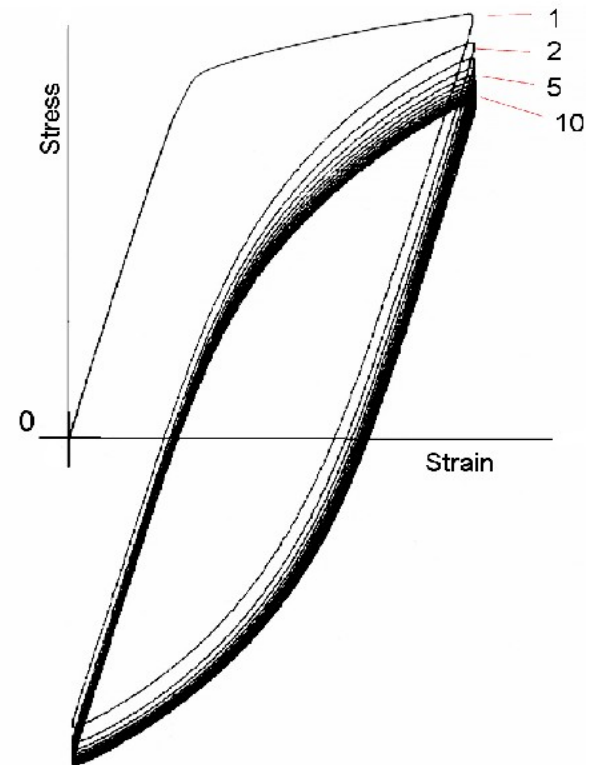
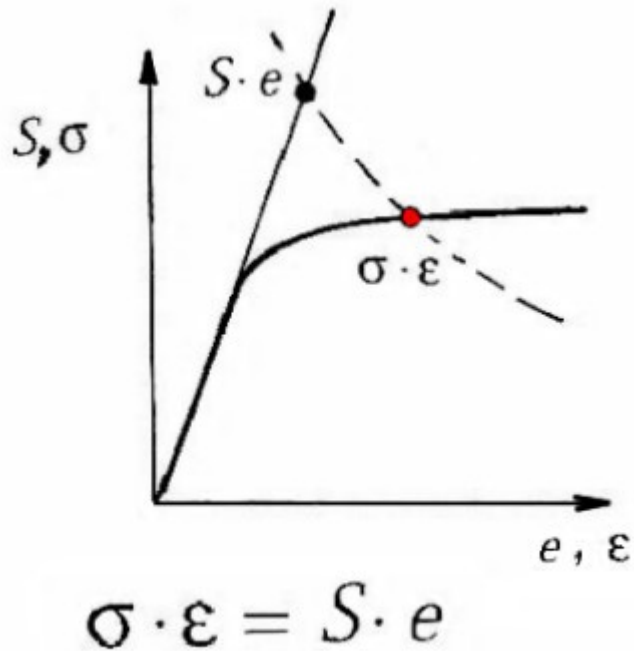
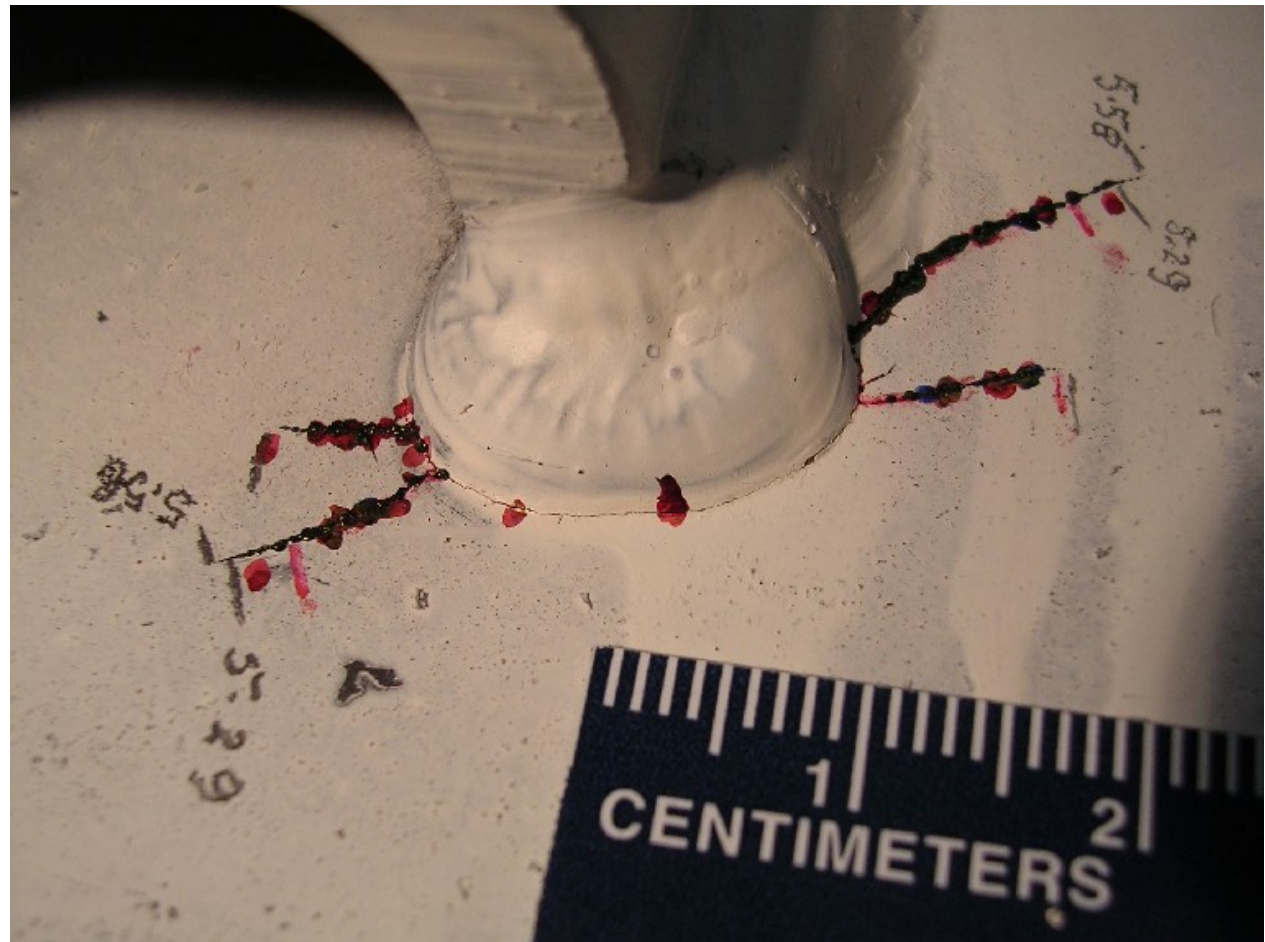


# The Interaction of Mean or Weld Residual Stress with the Neuber Plasticity Correction and the Effects on Fatigue Life Prediction

A. Conle

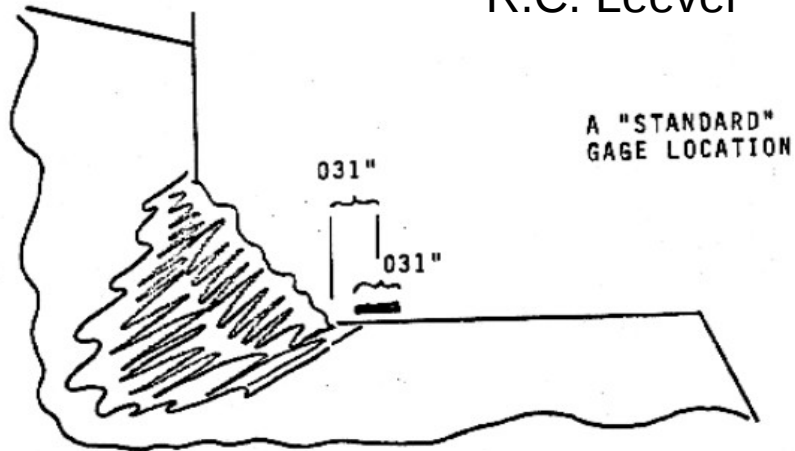
FDE Comm. Oct. 11, 2016



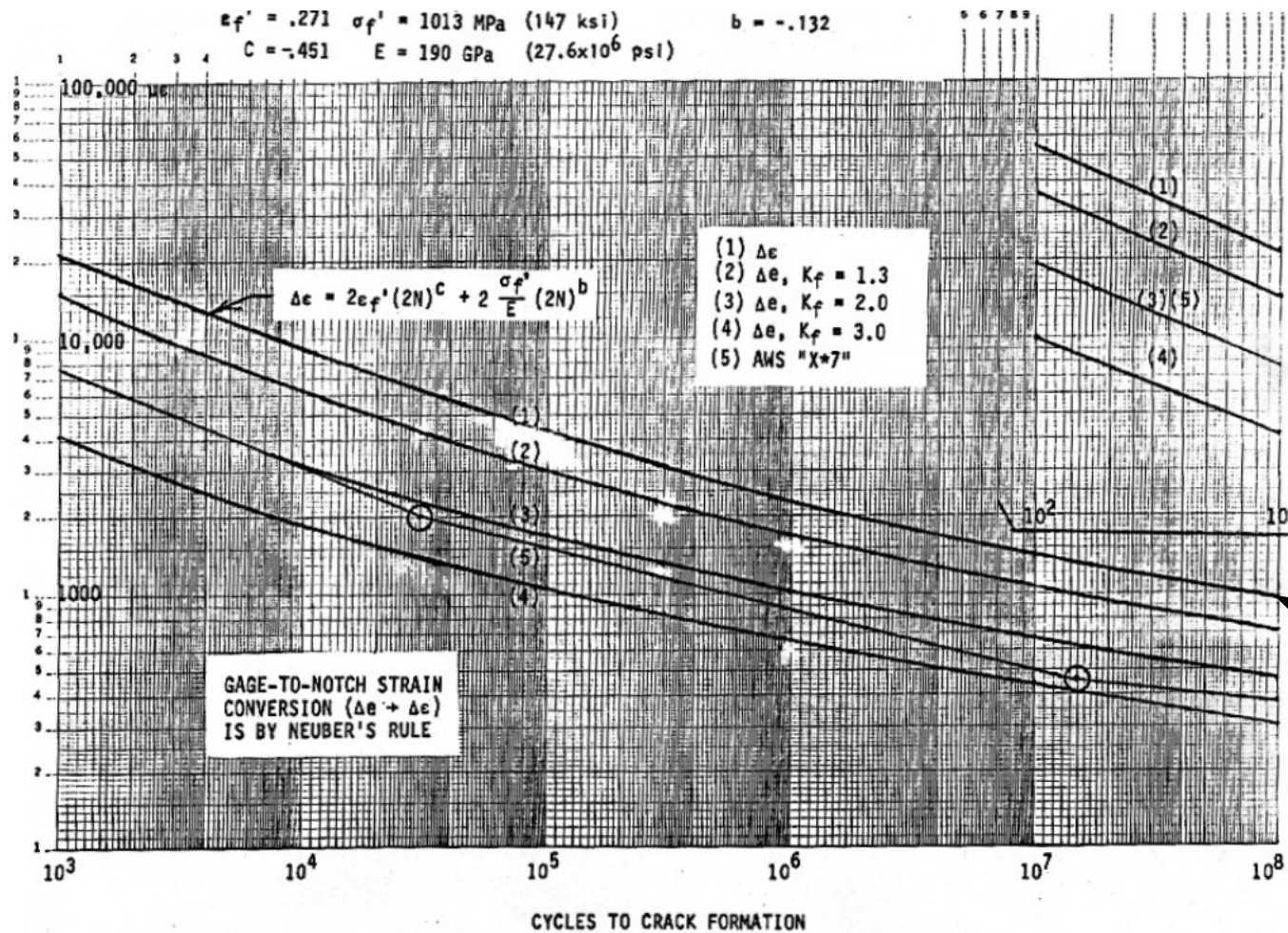
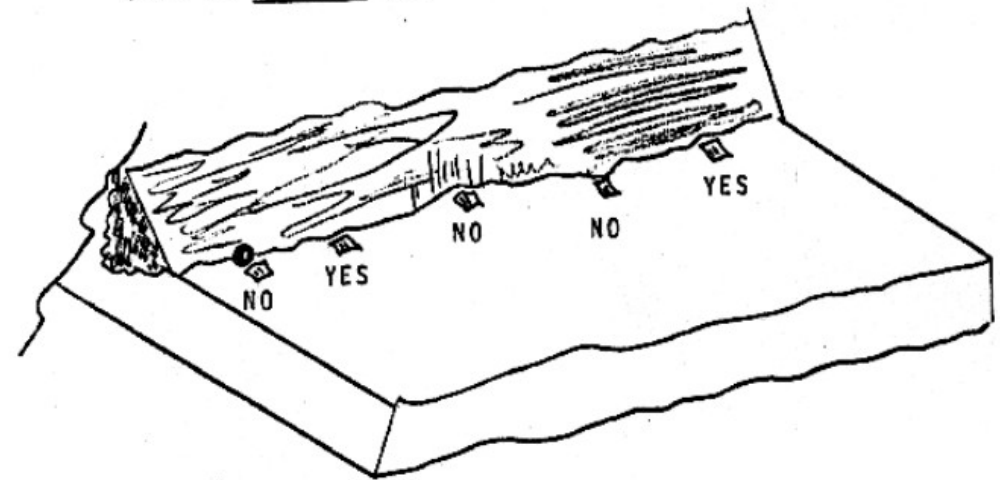


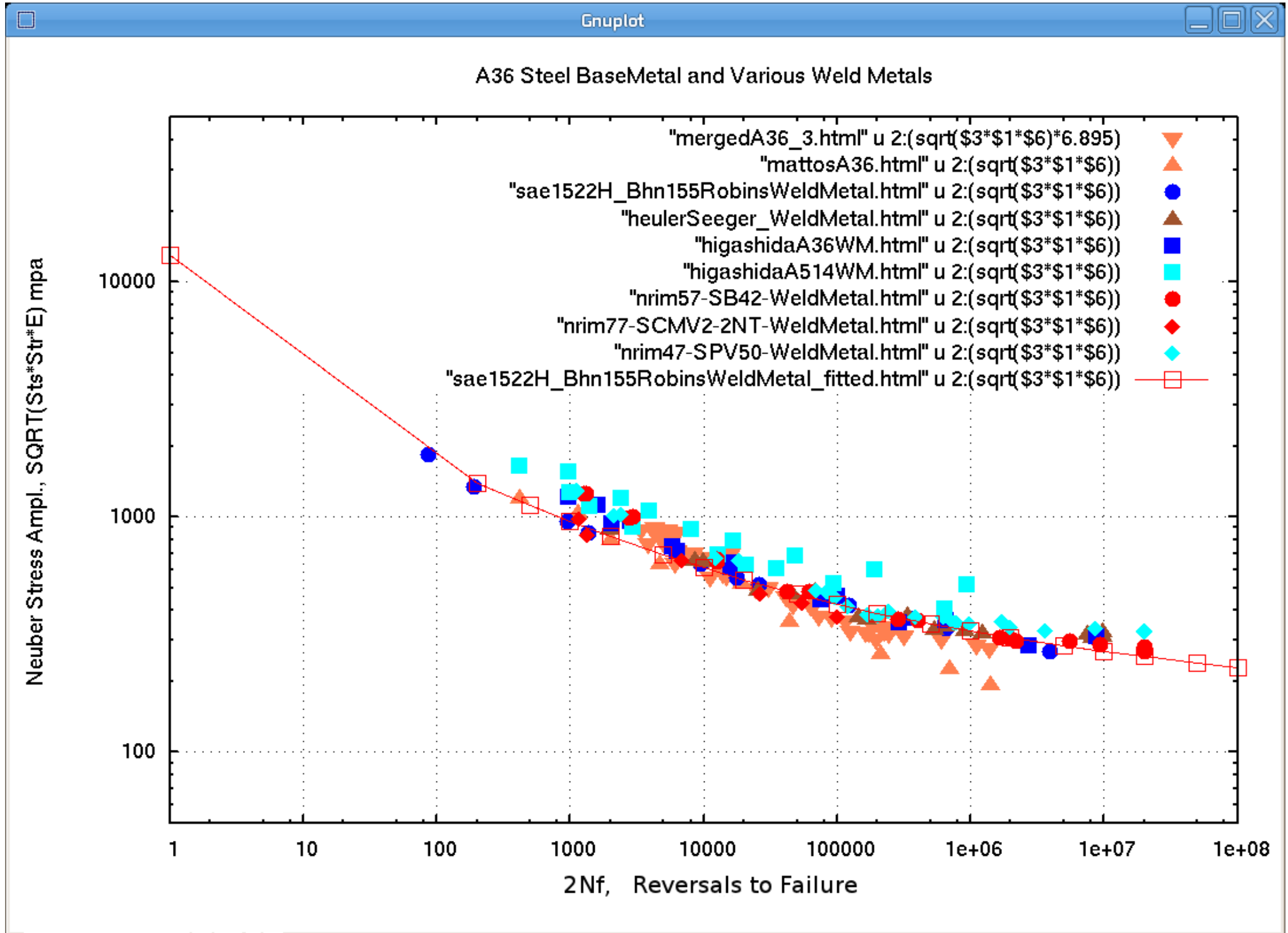
Surface Pit:  $K_t = 1.3$  (Hiam )  
 Internal Pore:  $K_t = 1.5$  ( Gurney Table 9.2 )  
 Slag Inclusions:  $K_f = 2$  (Gurney Fig. 9.11 in )  
 Machined Fillet:  $K_t = 2.0-2.8$  (Cordes, Perovic)

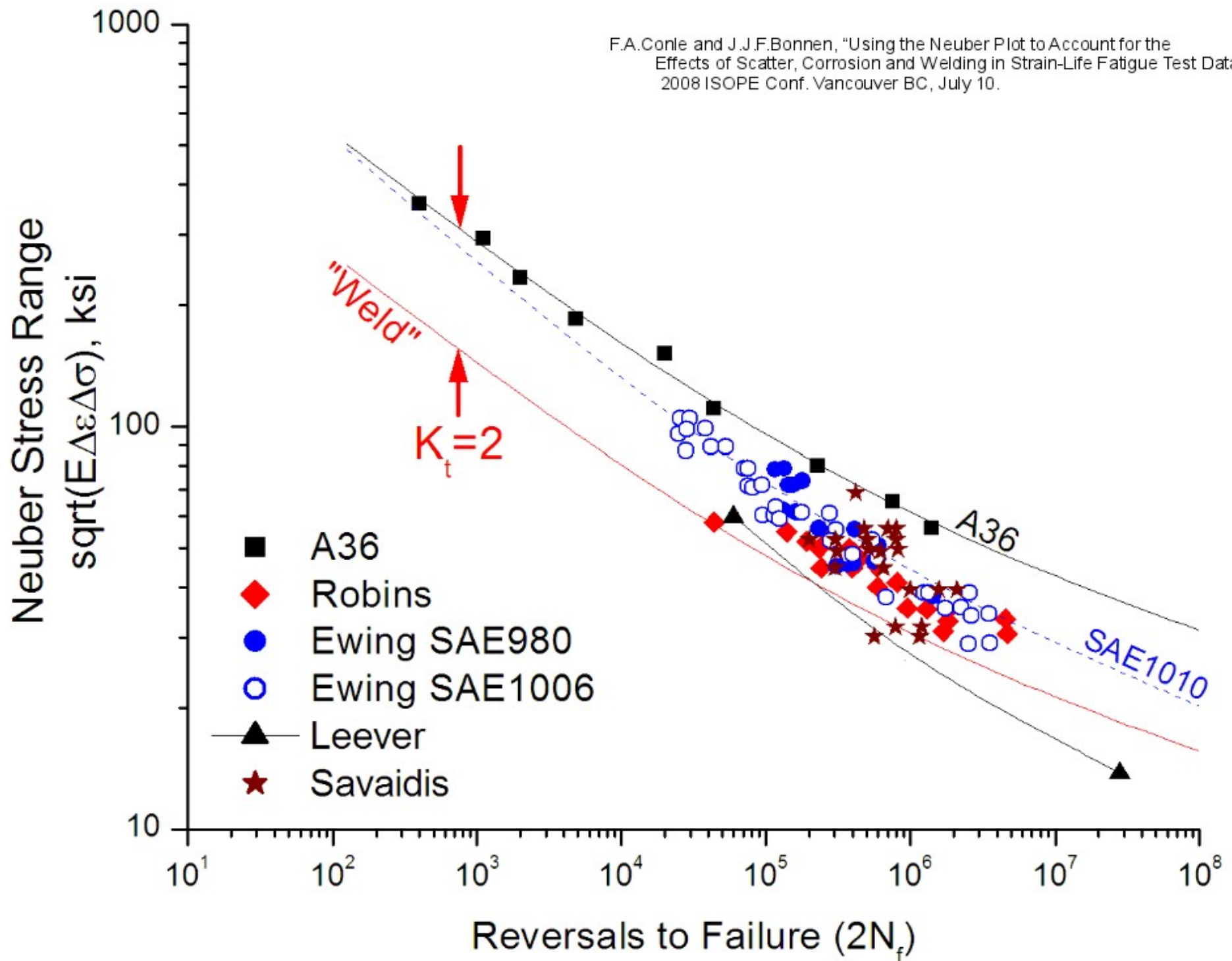
R.C. Leever

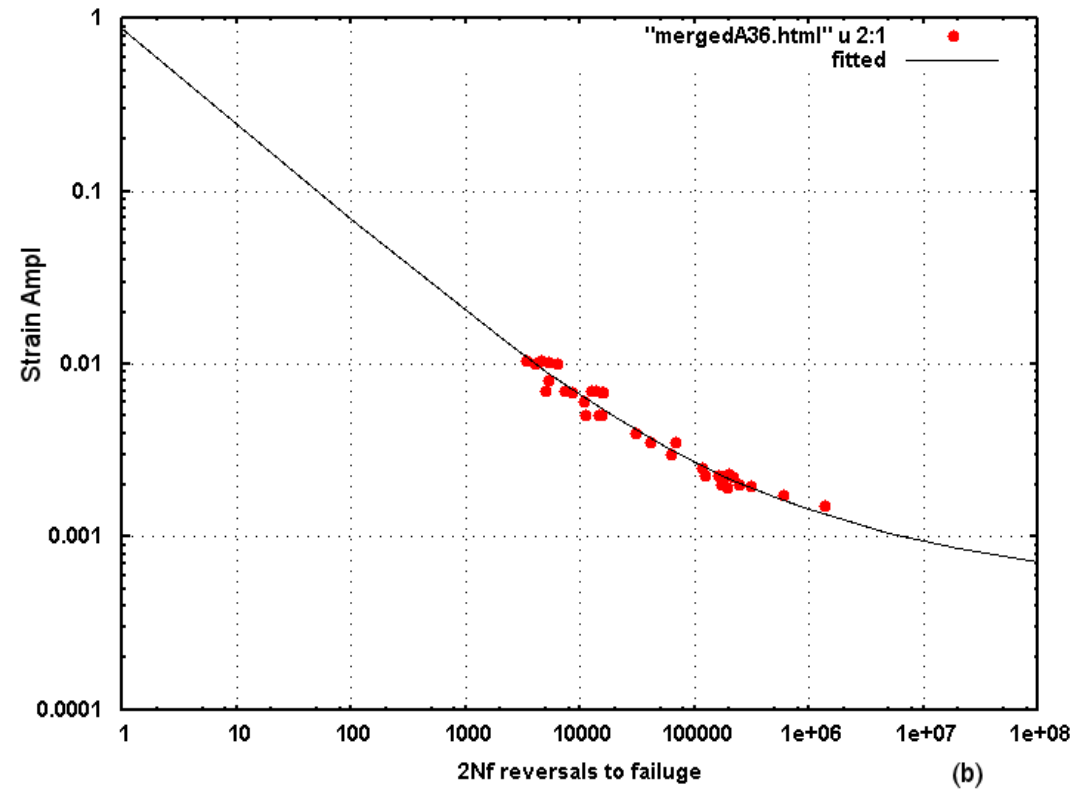
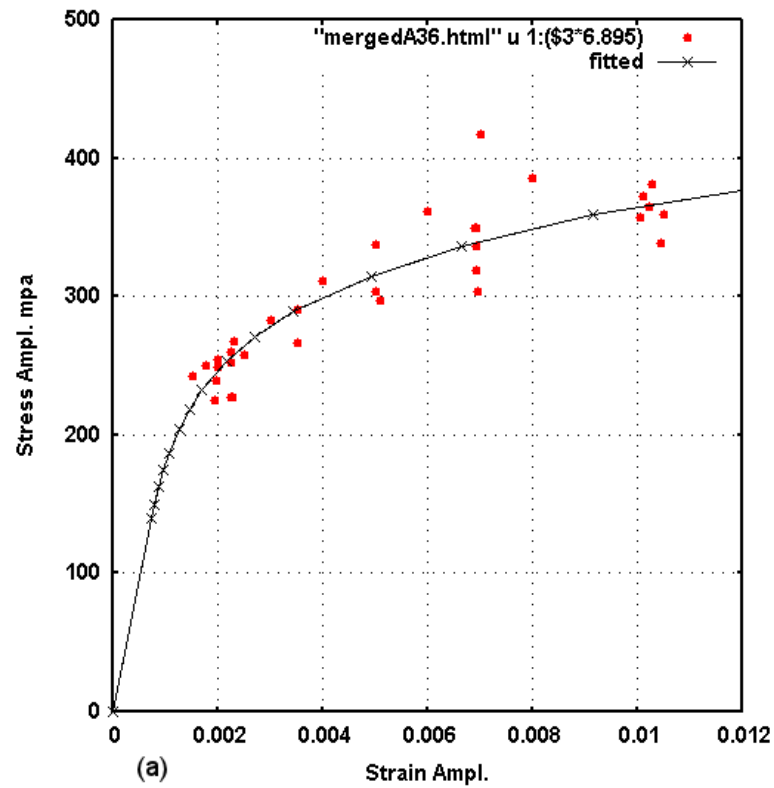


GAGE AT TYPICAL REGION AT FUSION LINE

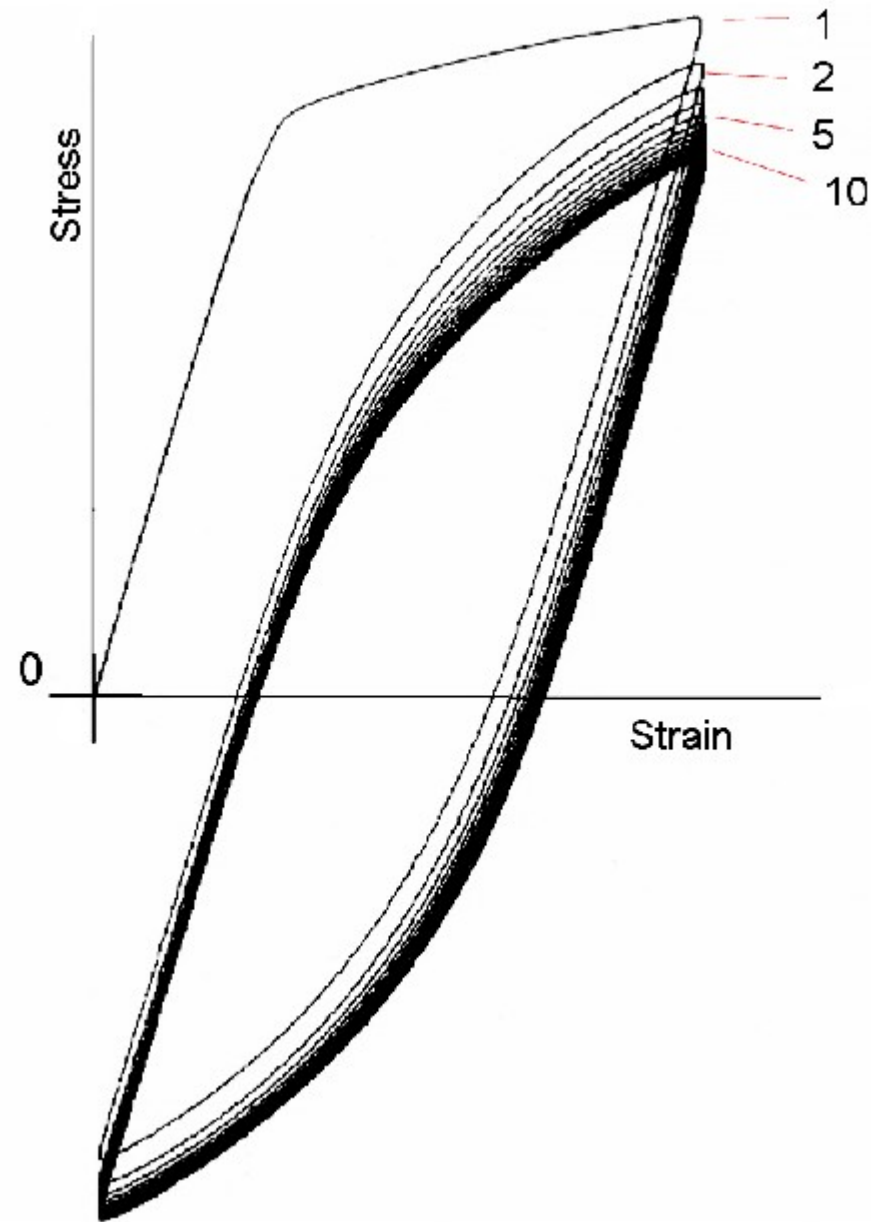


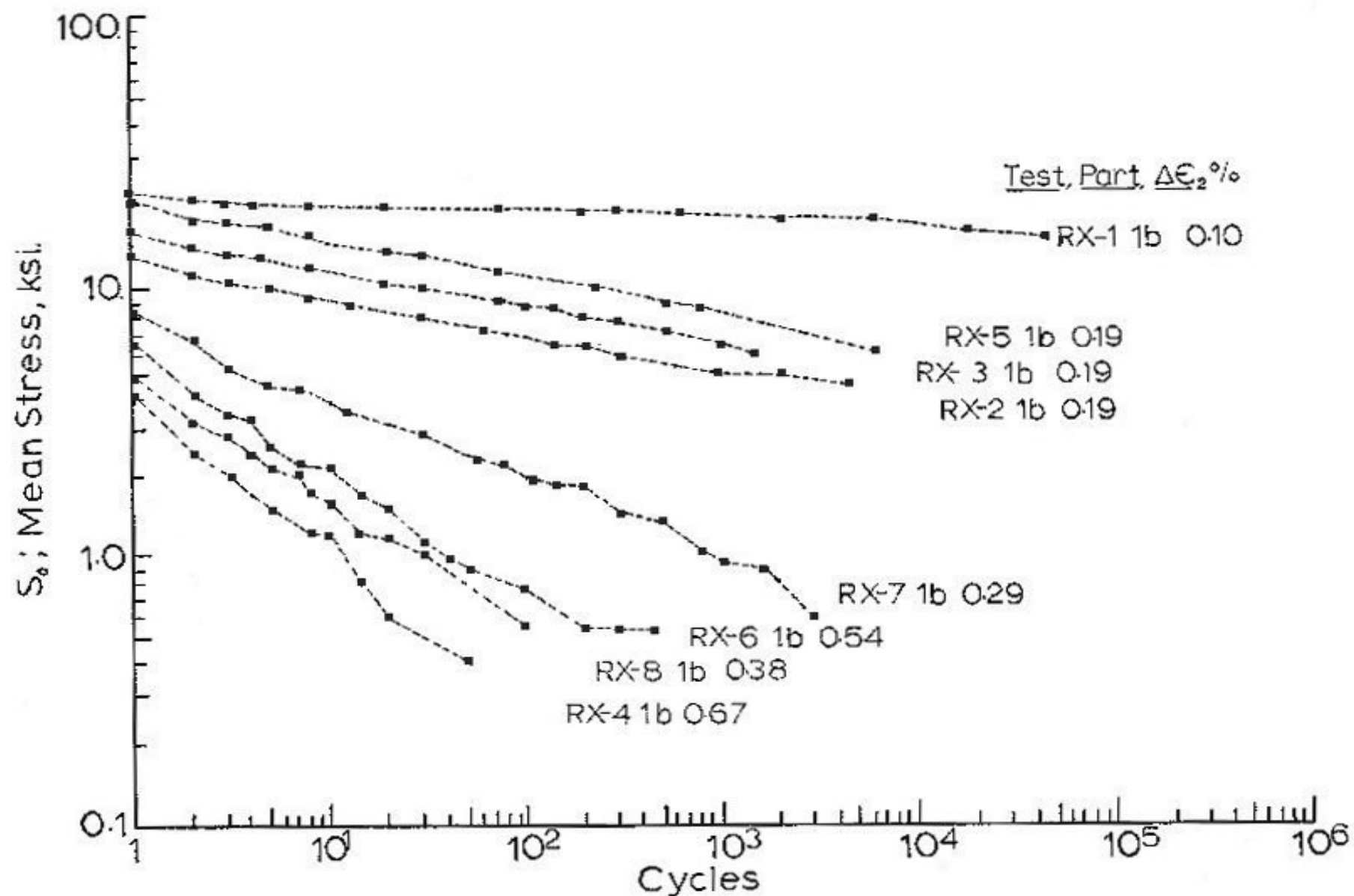




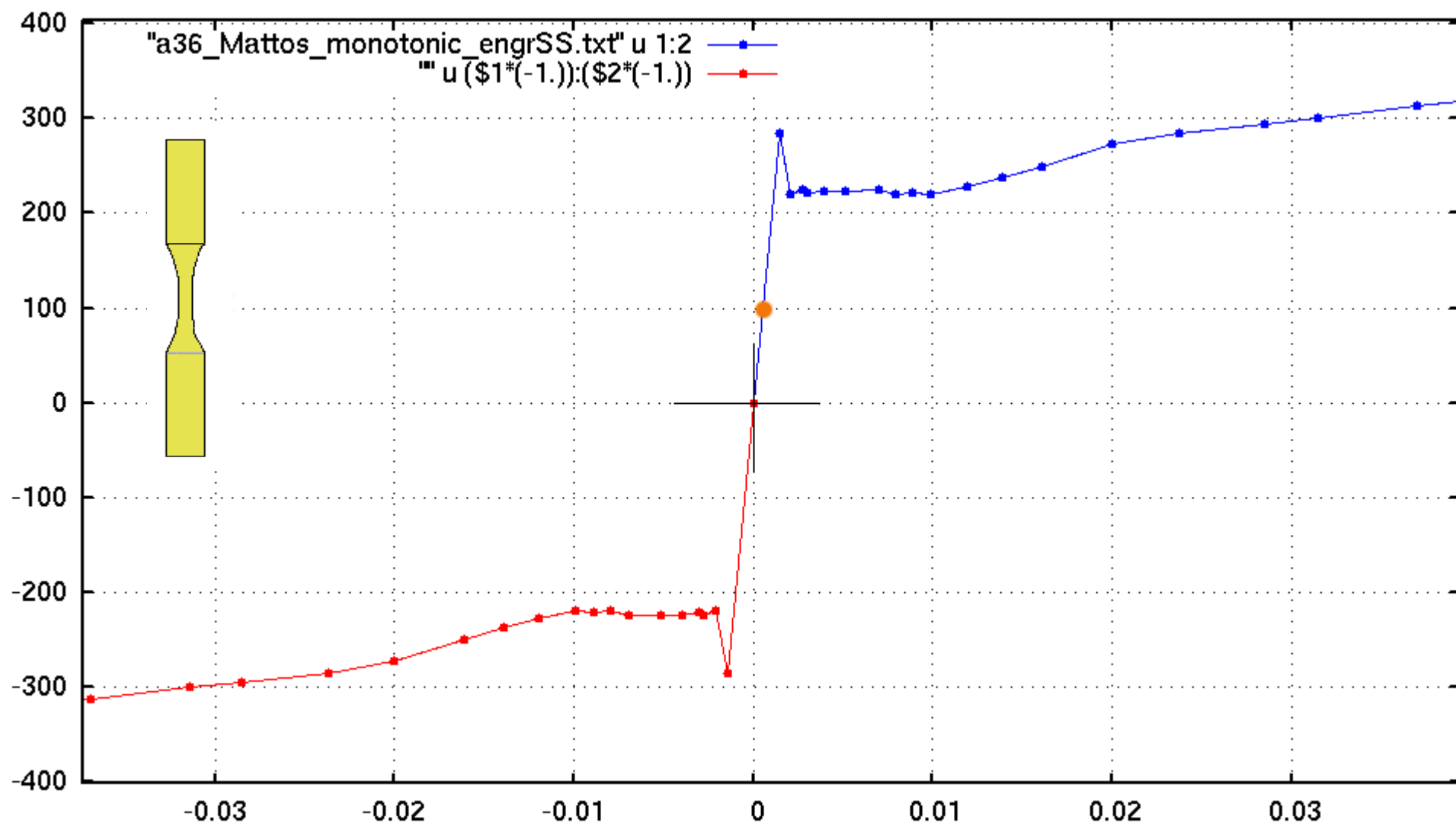


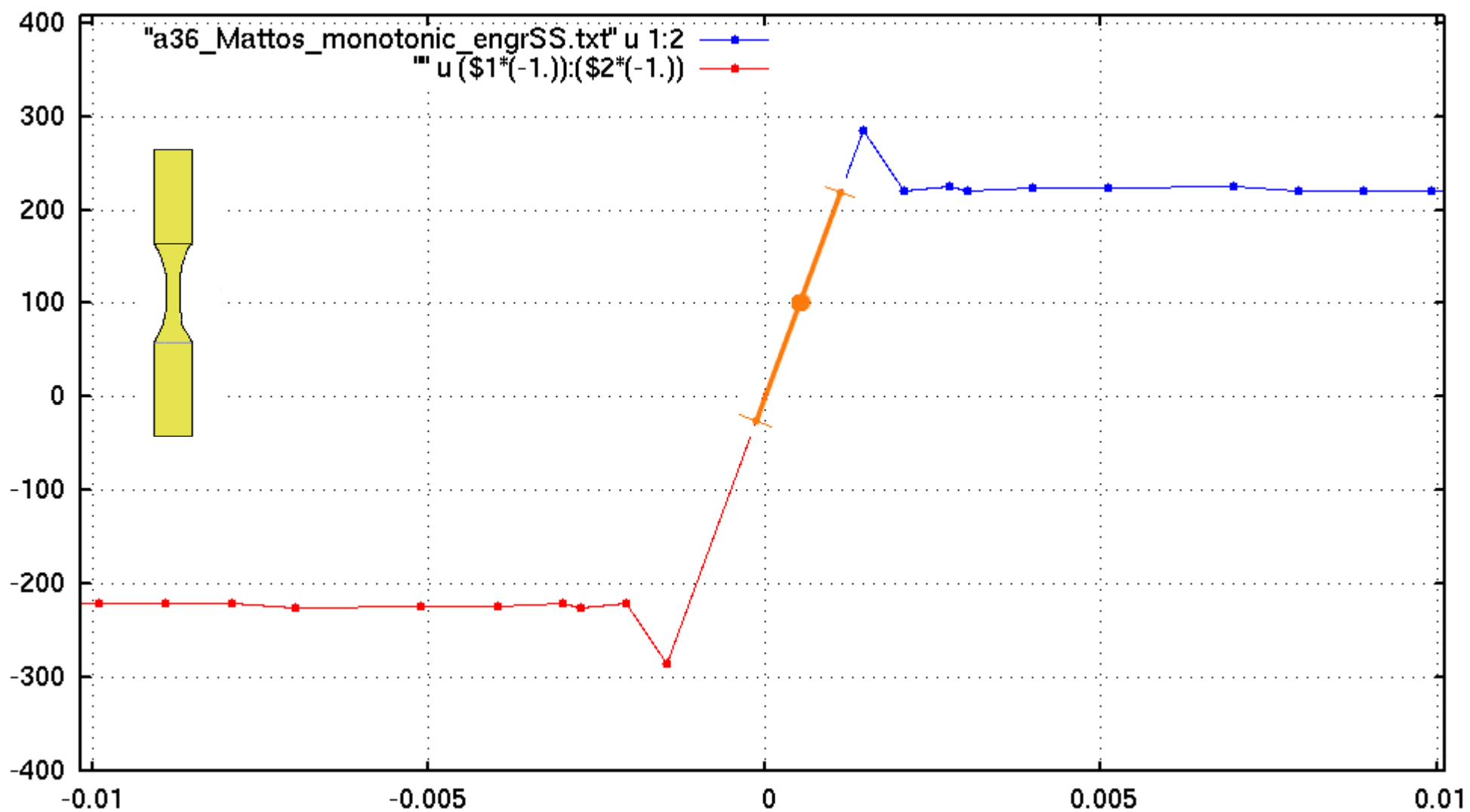
Summary: A36 Base metal steel +  $K_t = 2$ .

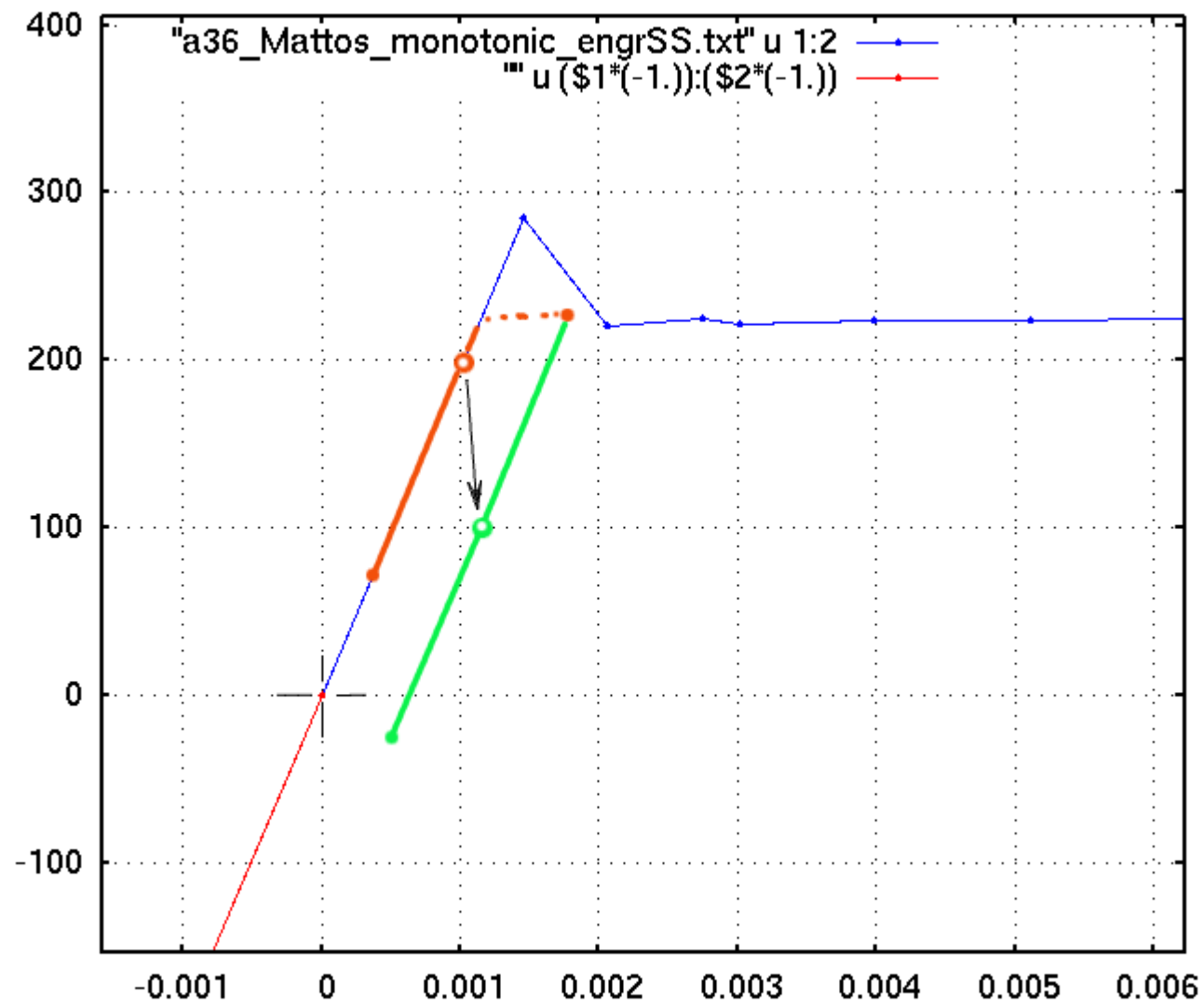
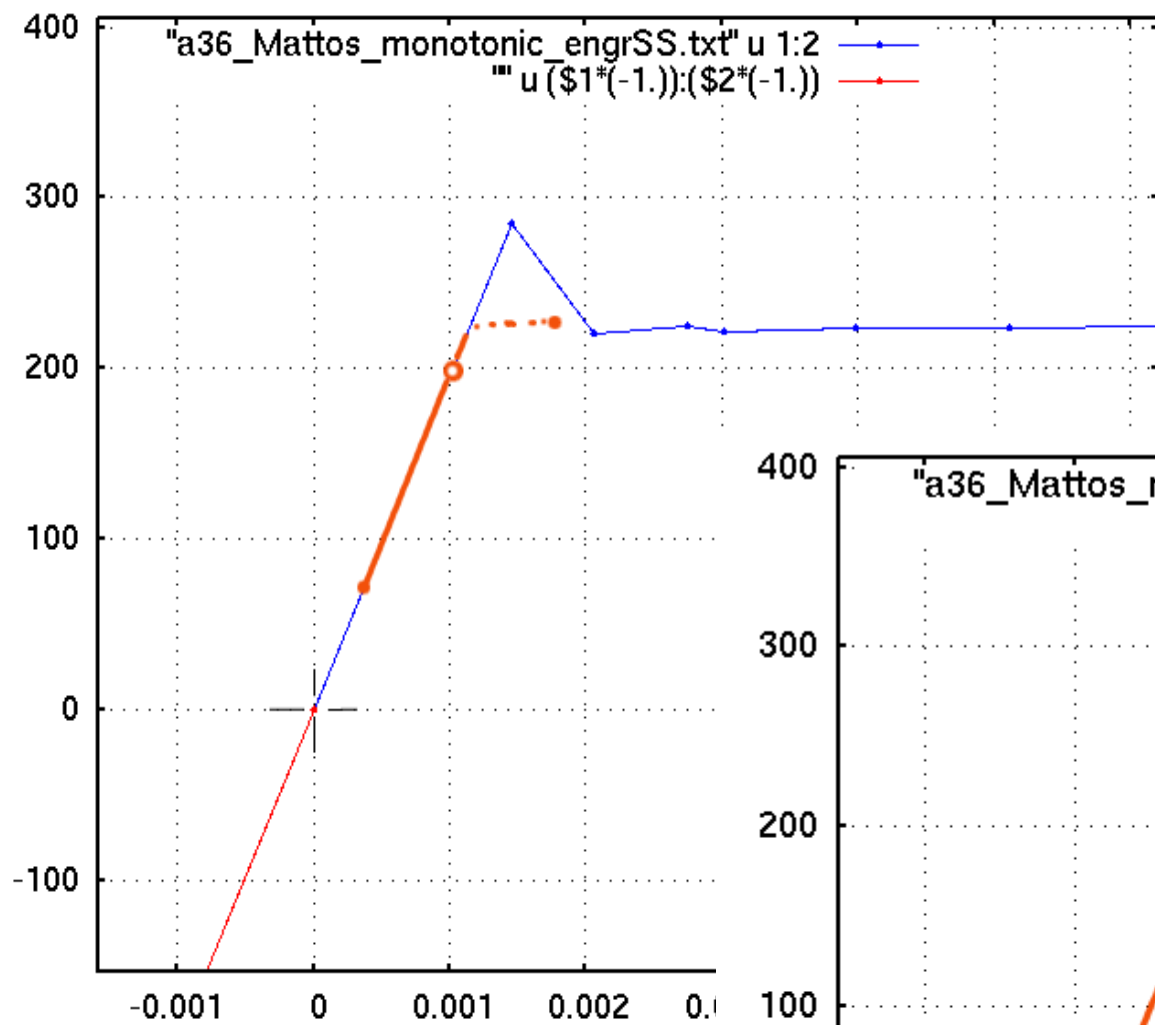


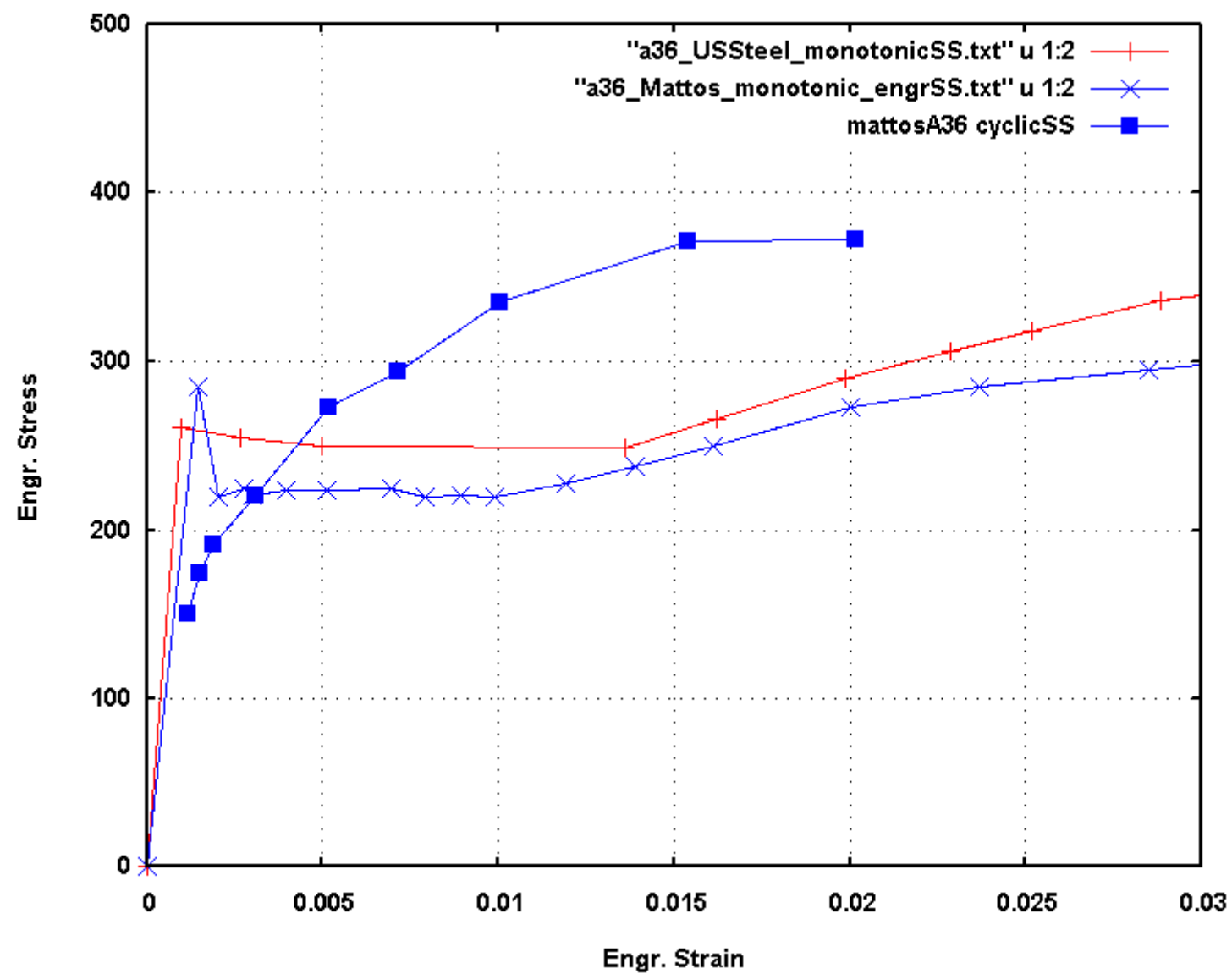


Mean Stress vs. Cycles at Secondary Strain Range  $\Delta\epsilon_2$  for Part 1b of all Tests. (First application of Cycles at  $\Delta\epsilon_2$  )

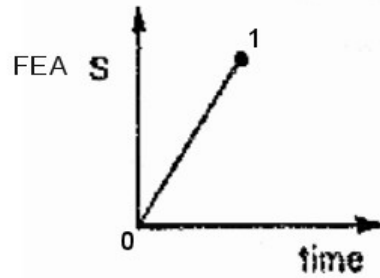




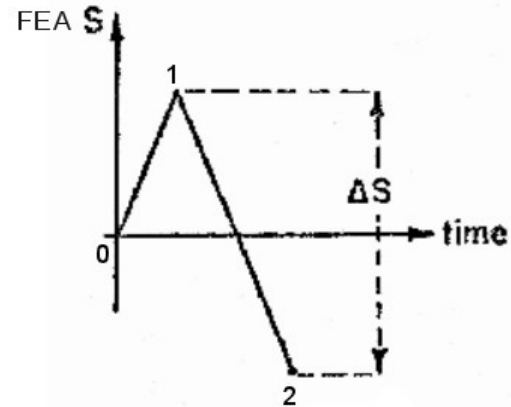
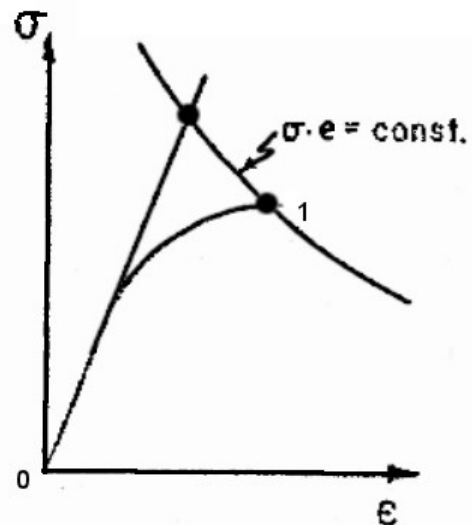




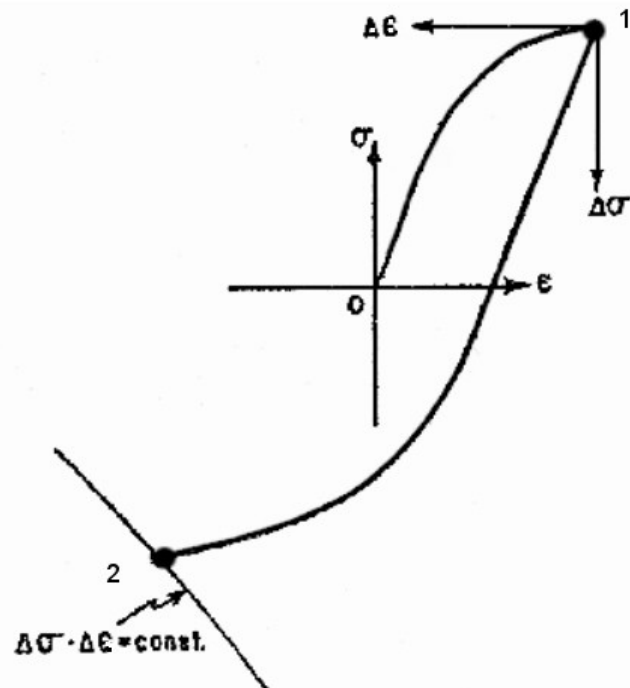
# Neuber Plasticity Correction



$$S * e = S * \frac{S}{E} = \text{Constant}$$



$$\Delta S * \frac{\Delta S}{E} = \text{constant} = \Delta \sigma * \Delta \epsilon$$





##  
#

## 1. Your Material (Digital-Fitted Curves):

#

```
#
#saediacurve_v2.2.f starts.
# NOTE!! The Following Points are <b>FITTED DATA:</b>#NOTE!! Fitted Stress computed using Experim. K'
and n'
# 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
```

Scroll to  
view or adjust  
Fitted Curve file

#

## 2. History Magnification or Multiplication factor

#

Note Units!

## 3. Enter Elastic $K_t$ \*Nominal (or Finite Element) Stress History (Rainflow counted cycle sets) Below:

MPa !

- Cycle Set #1 : Smax  Smin  Cycles
- Cycle Set #2 : Smax  Smin  Cycles
- Cycle Set #3 : Smax  Smin  Cycles
- Cycle Set #4 : Smax  Smin  Cycles
- Cycle Set #5 : Smax  Smin  Cycles
- Cycle Set #6 : Smax  Smin  Cycles

Enter your Nominal  
Stress Cycles here

#

## 4. (Page will be submitted to UoWaterloo Website)

Click to get Neuber corrected  
fatigue results

#

How to Use: [http://fde.uwaterloo.ca/Fde/Notches.new/a36calc\\_Image.jpg](http://fde.uwaterloo.ca/Fde/Notches.new/a36calc_Image.jpg)

Calculator A36: [http://fde.uwaterloo.ca/Fde/Materials/Steel/Lowcarbon/mergedA36\\_fc.html](http://fde.uwaterloo.ca/Fde/Materials/Steel/Lowcarbon/mergedA36_fc.html)

```
#read_a_line: # #MagFactor 1.0 383.3 38.33 1
```

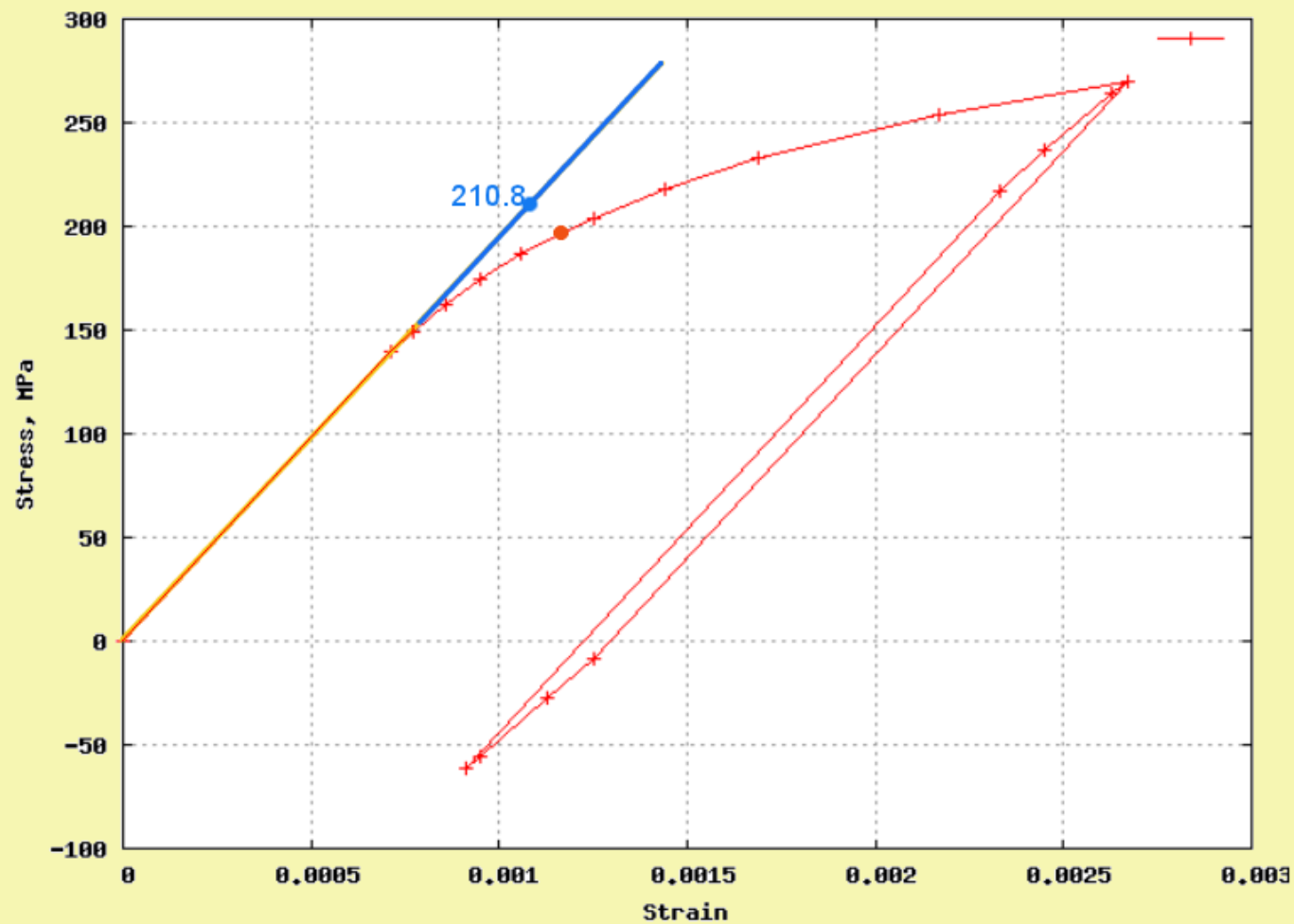
## Nominal and Local Stress-Strain:

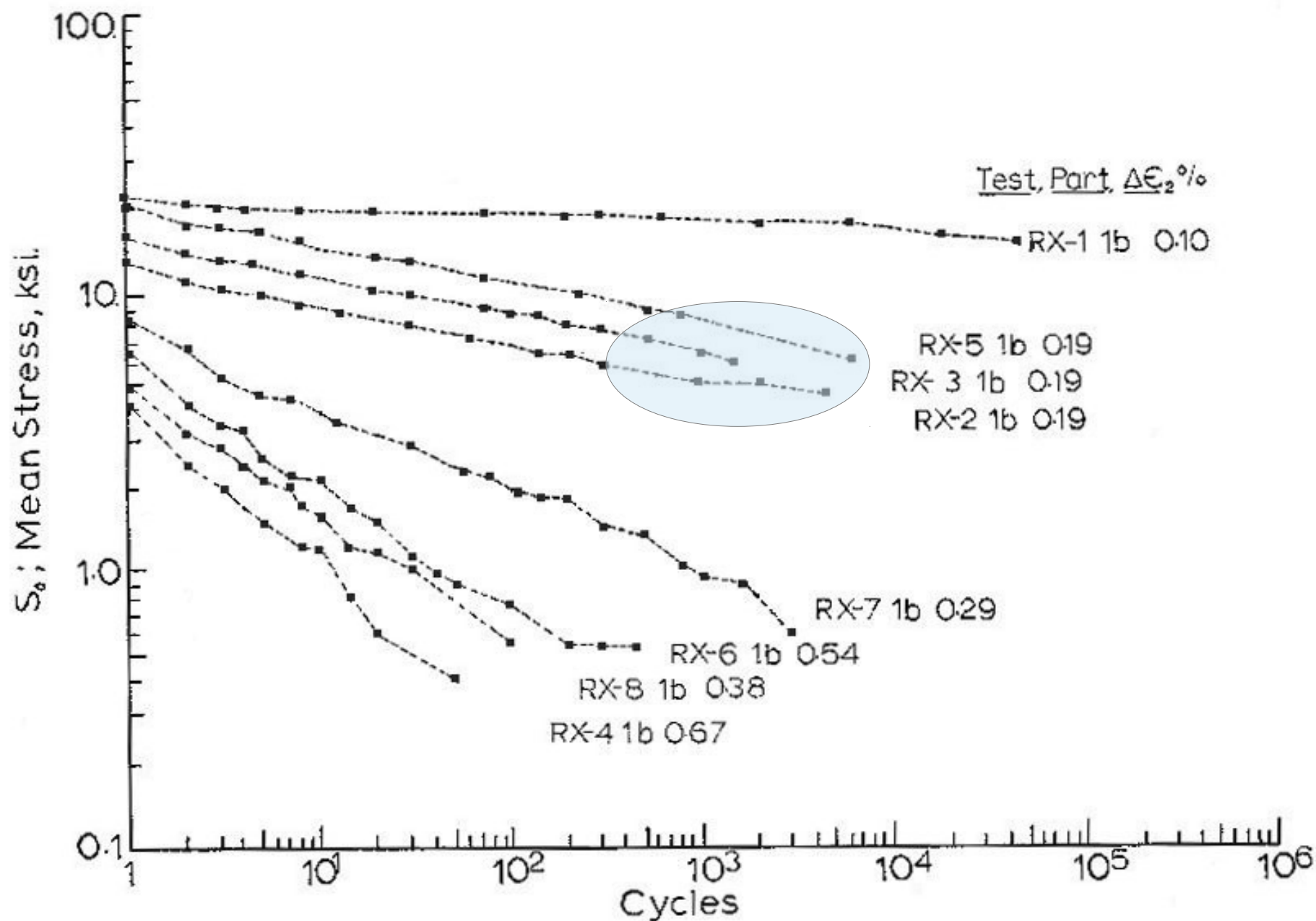
```
#xcalc2 Loop    Smax    Smin          N Sigmax  Sigmin Delta Epsmax Epsmin DeltaEps  %Eps %SwAt %Sts %Morr
#xcalc2    1    383.3    38.3          1.0  270.   -61.   331.  0.00267 0.00091 0.00176 100.0 100.0 100.0 100
```

## Life Predictions (history repetitions):

```
#xcalc3 StrainLife_Reps SwAt_Life_Reps StressLife_Reps  Morrow_Reps  Goodman_Reps (Reps= Repetitions)
#xcalc3  8372412.5      1279926.1      8372421.5      2022331.6      659786.1
```

## Local Stress and Strain Response:





Mean Stress vs. Cycles at Secondary Strain Range  $\Delta\epsilon_2$  for Part 1b of all Tests. (First application of Cycles at  $\Delta\epsilon_2$  )

#read\_a\_line: # #MagFactor 1.0 862.5 517.5 1

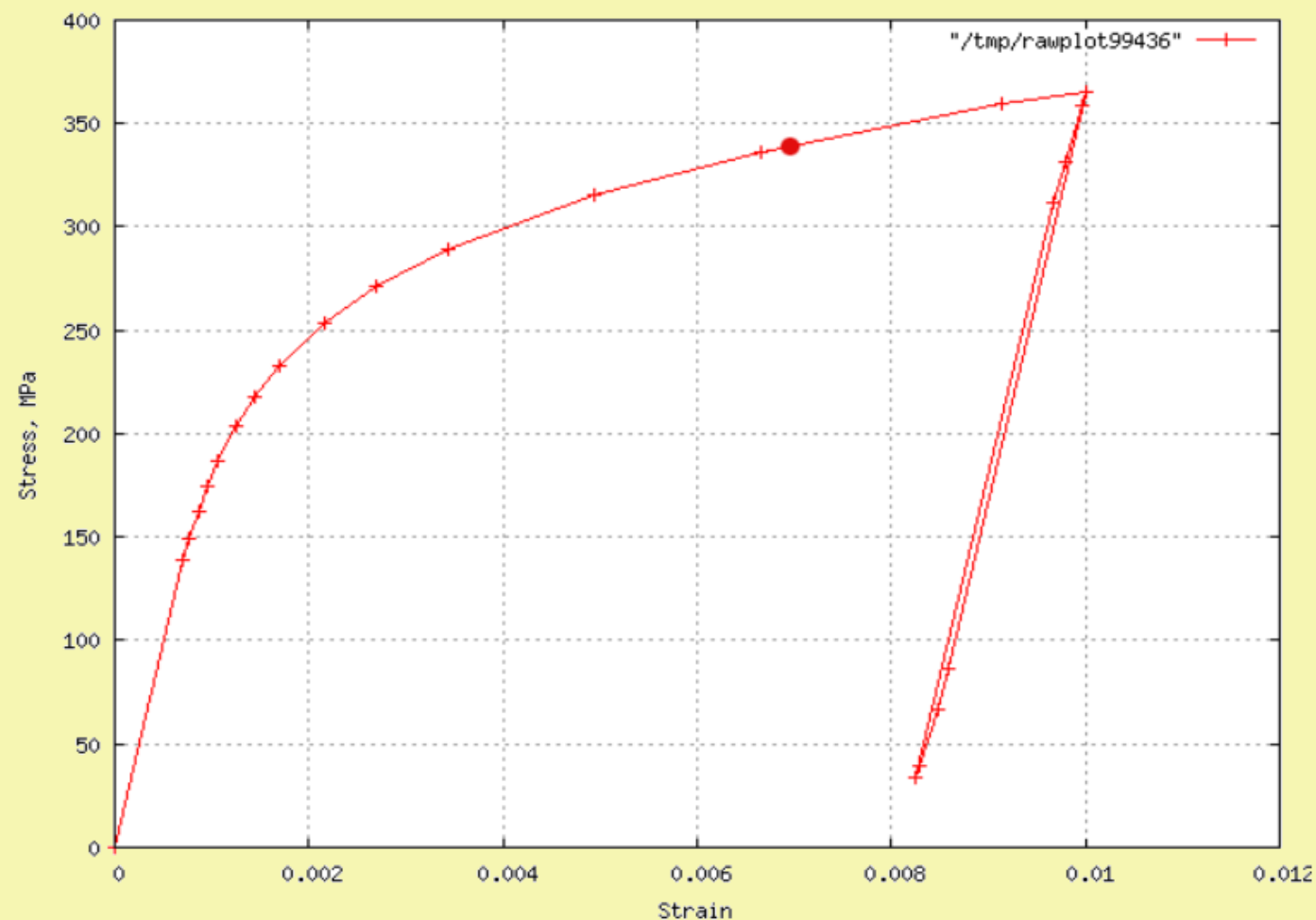
## Nominal and Local Stress-Strain:

#xcalc2	Loop	Smax	Smin	N	Sigmax	Sigmin	Delta	Epsmax	Epsmin	DeltaEps	%Eps	%SwaT	%Sts	%Morr
#xcalc2	1	862.5	517.5	1.0	365.	34.	331.	0.01001	0.00825	0.00176	100.0	100.0	100.0	100.

## Life Predictions (history repetitions):

#xcalc3	StrainLife_Reps	SwaT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps (Reps= Repetitions)
#xcalc3	8366466.5	461921.8	8366475.5	430204.2	29437.2

## Local Stress and Strain Response:



#read\_a\_line: # #MagFactor 2.0 172.5 -172.5 1

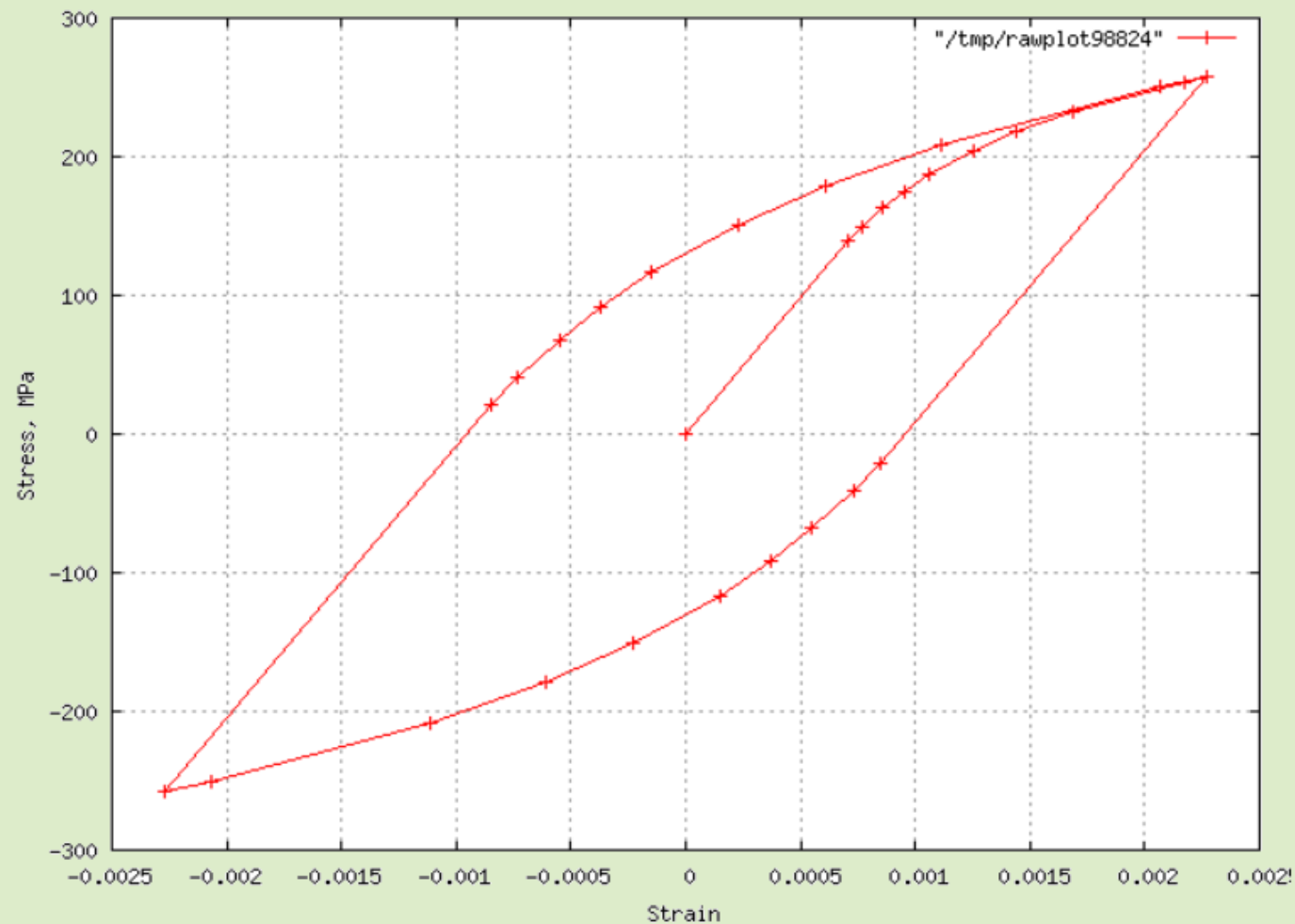
## Nominal and Local Stress-Strain:

#xcalc2	Loop	Smax	Smin	N	Sigmax	Sigmin	Delta	Epsmax	Epsmin	DeltaEps	%Eps	%SwaT	%Sts
#xcalc2	1	345.0	-345.0	1.0	257.	-257.	515.	0.00227	-.00227	0.00454	100.0	100.0	100.

## Life Predictions (history repetitions):

#xcalc3	StrainLife_Reps	SwaT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps	(Reps= Repetition)
#xcalc3	86388.6	86388.6	86388.3	86388.3	86388.3	

## Local Stress and Strain Response:



#read\_a\_line: # #MagFactor 2.0 383.3 38.33 1

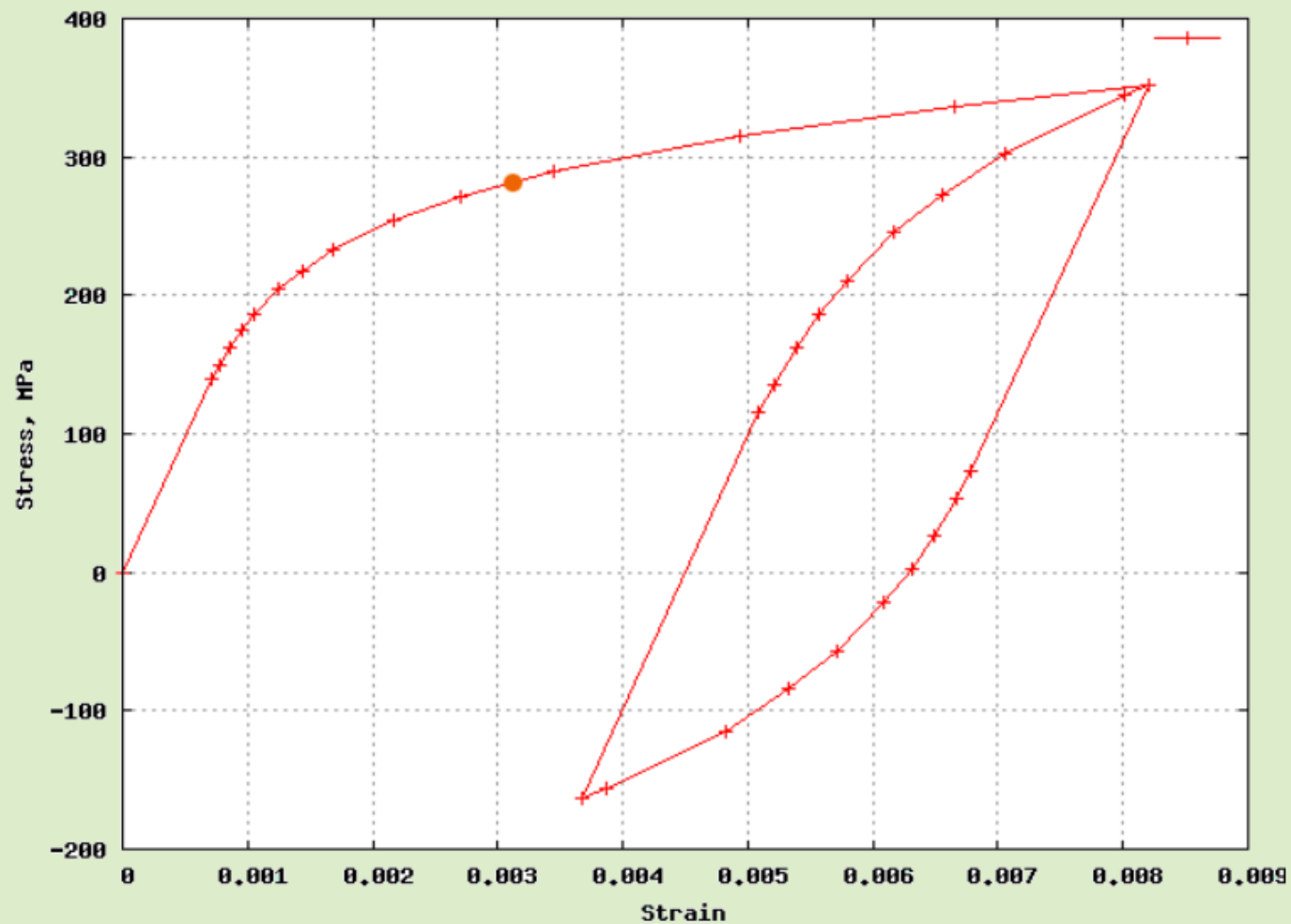
## Nominal and Local Stress-Strain:

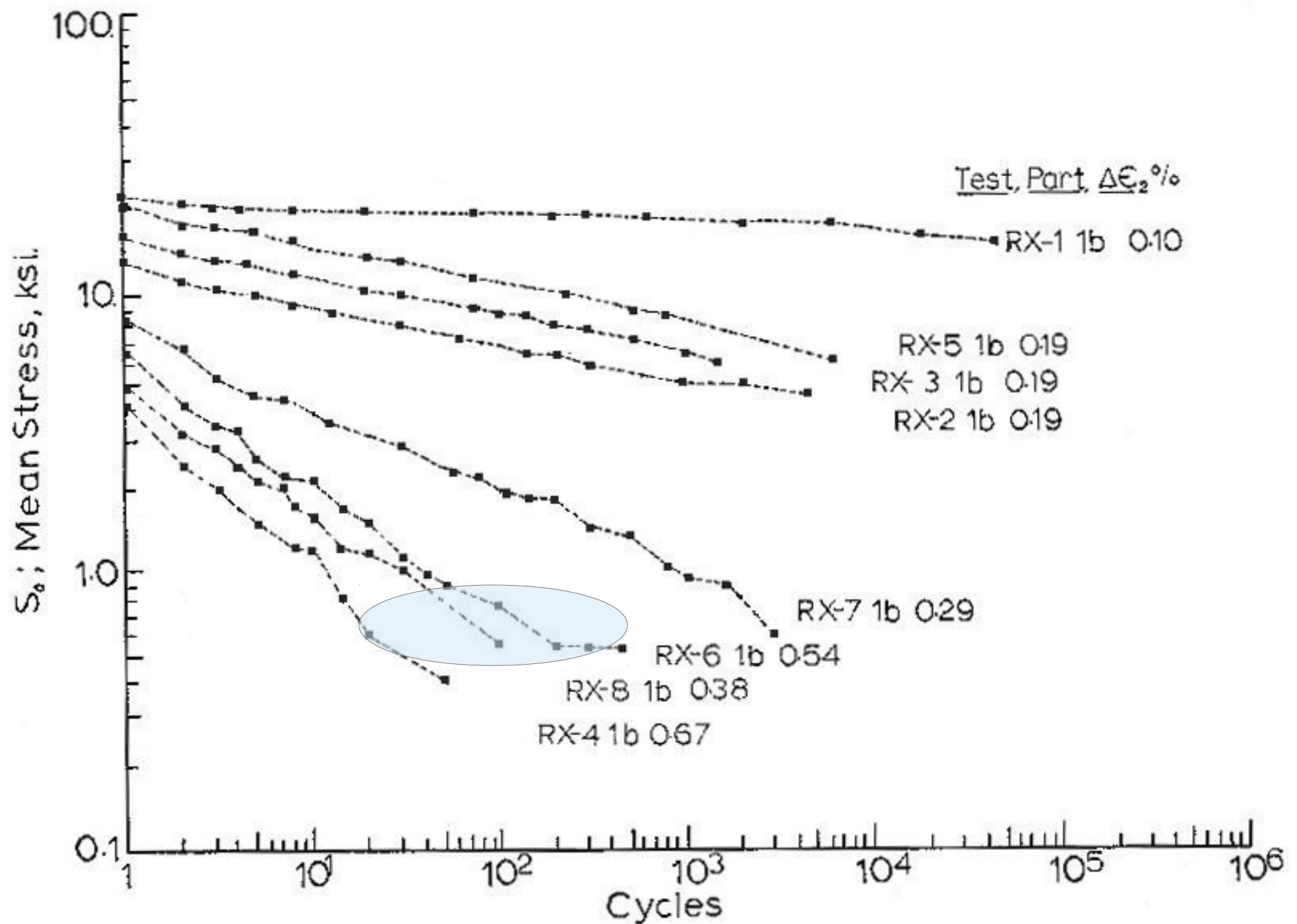
#xcalc2	Loop	Smax	Smin	N	Sigmax	Sigmin	Delta	Epsmax	Epsmin	DeltaEps	%Eps	%SwaT	%Sts	%Morr
#xcalc2	1	766.6	76.7	1.0	351.	-163.	515.	0.00821	0.00367	0.00454	100.0	100.0	100.0	100

## Life Predictions (history repetitions):

#xcalc3	StrainLife_Reps	SwaT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps (Reps= Repetions)
#xcalc3	86425.3	41086.0	86425.3	22992.0	8290.0

## Local Stress and Strain Response:





Mean Stress vs. Cycles at Secondary Strain Range  $\Delta\epsilon_2$  for Part 1b of all Tests. (First application of Cycles at  $\Delta\epsilon_2$ )

#read\_a\_line: # #MagFactor 2.0 517.5 172.5 1

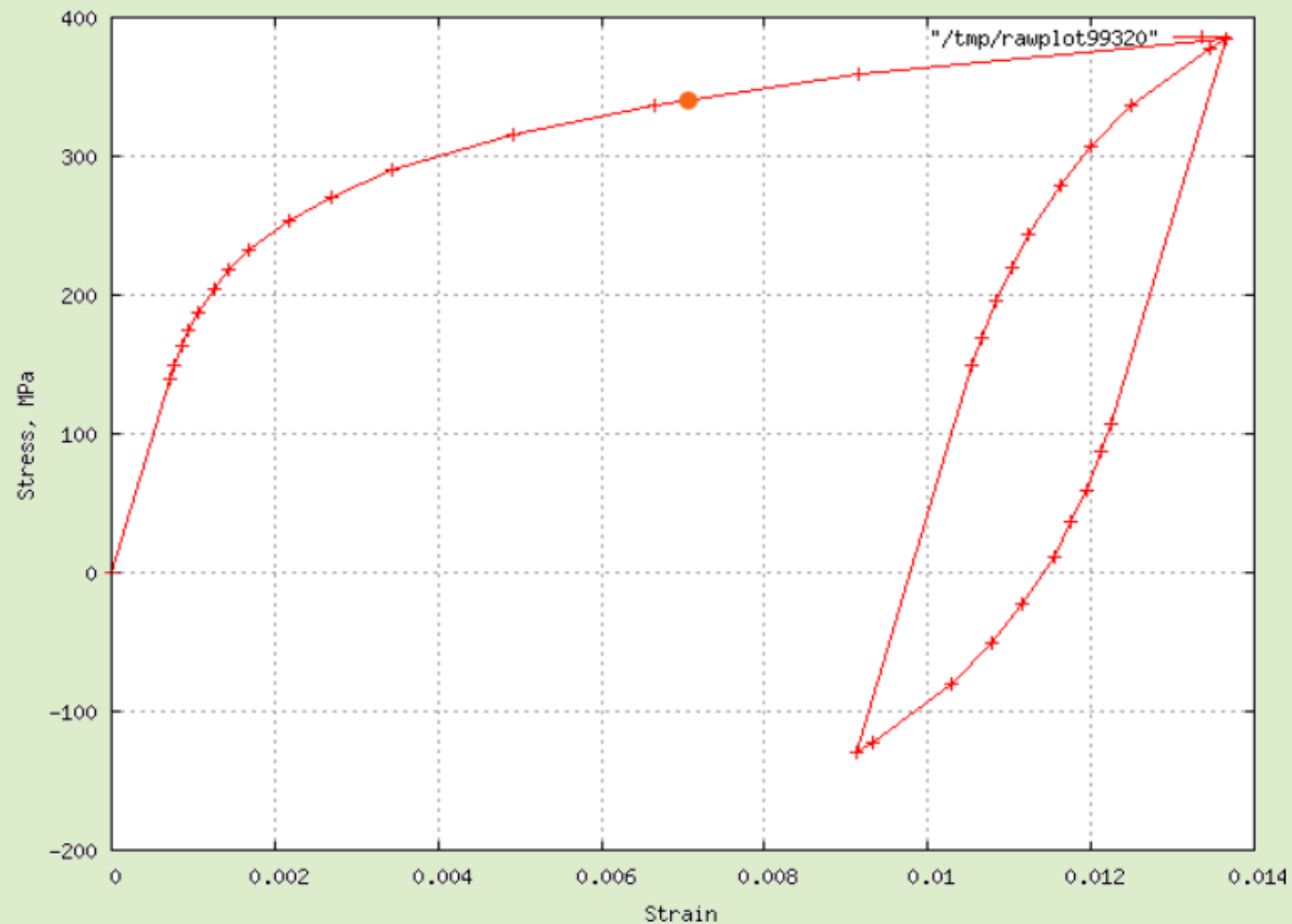
## Nominal and Local Stress-Strain:

#xcalc2	Loop	Smax	Smin	N	Sigmax	Sigmin	Delta	Epsmax	Epsmin	DeltaEps	%Eps	%SwAT	%Sts	%Morr
#xcalc2	1	1035.0	345.0	1.0	385.	-129.	515.	0.01366	0.00912	0.00454	100.0	100.0	100.0	100

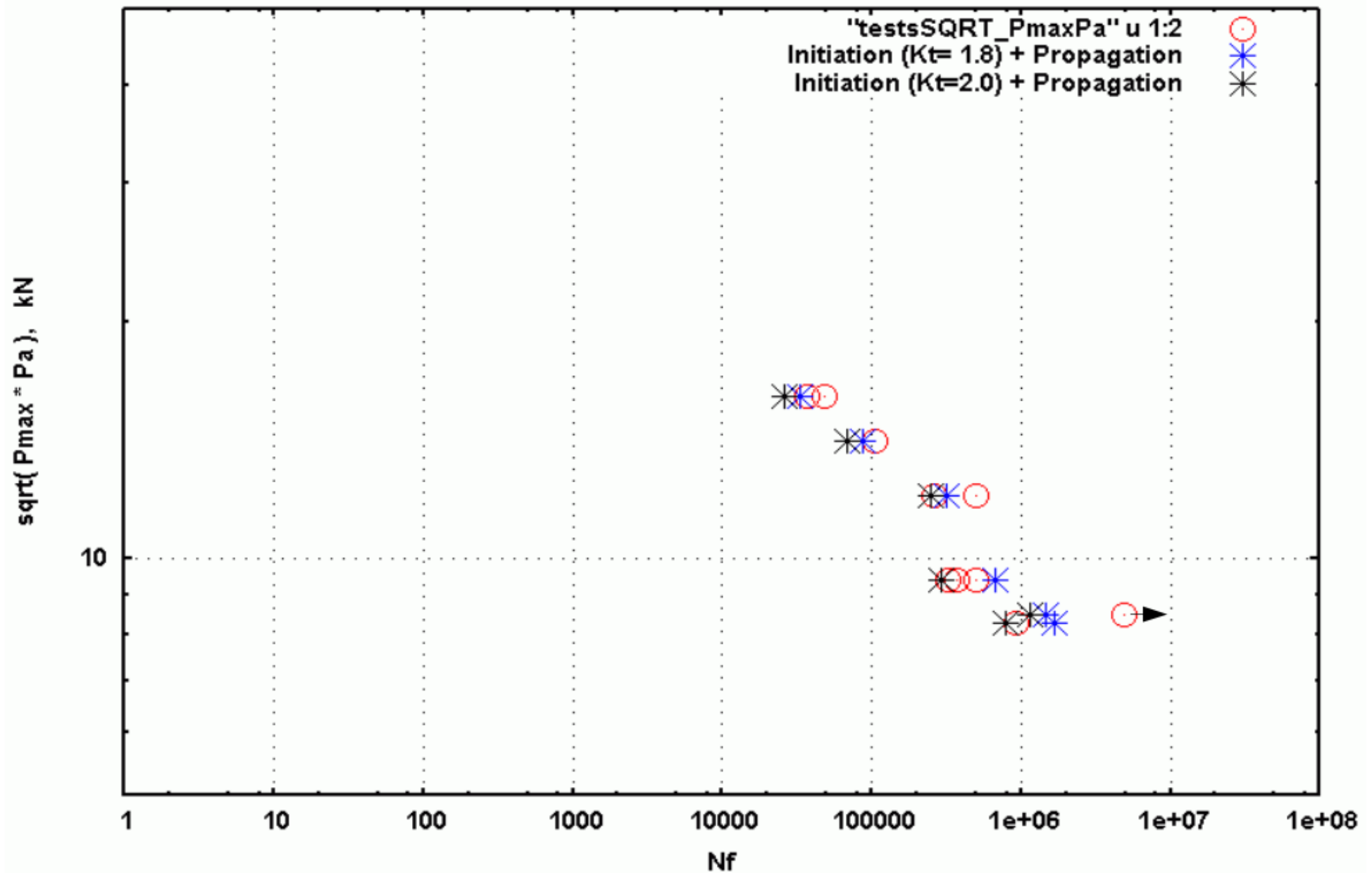
## Life Predictions (history repetitions):

#xcalc3	StrainLife_Reps	SwAT_Life_Reps	StressLife_Reps	Morrow_Reps	Goodman_Reps (Reps= Repetions)
#xcalc3	86388.6	33424.0	86388.3	13447.4	3110.2

## Local Stress and Strain Response:



Test Sample Life and Initiation + Propagation Life, F.D.E. "T" Specimens



Simulation of Constant Amplitude F.D.E. "T"Tests



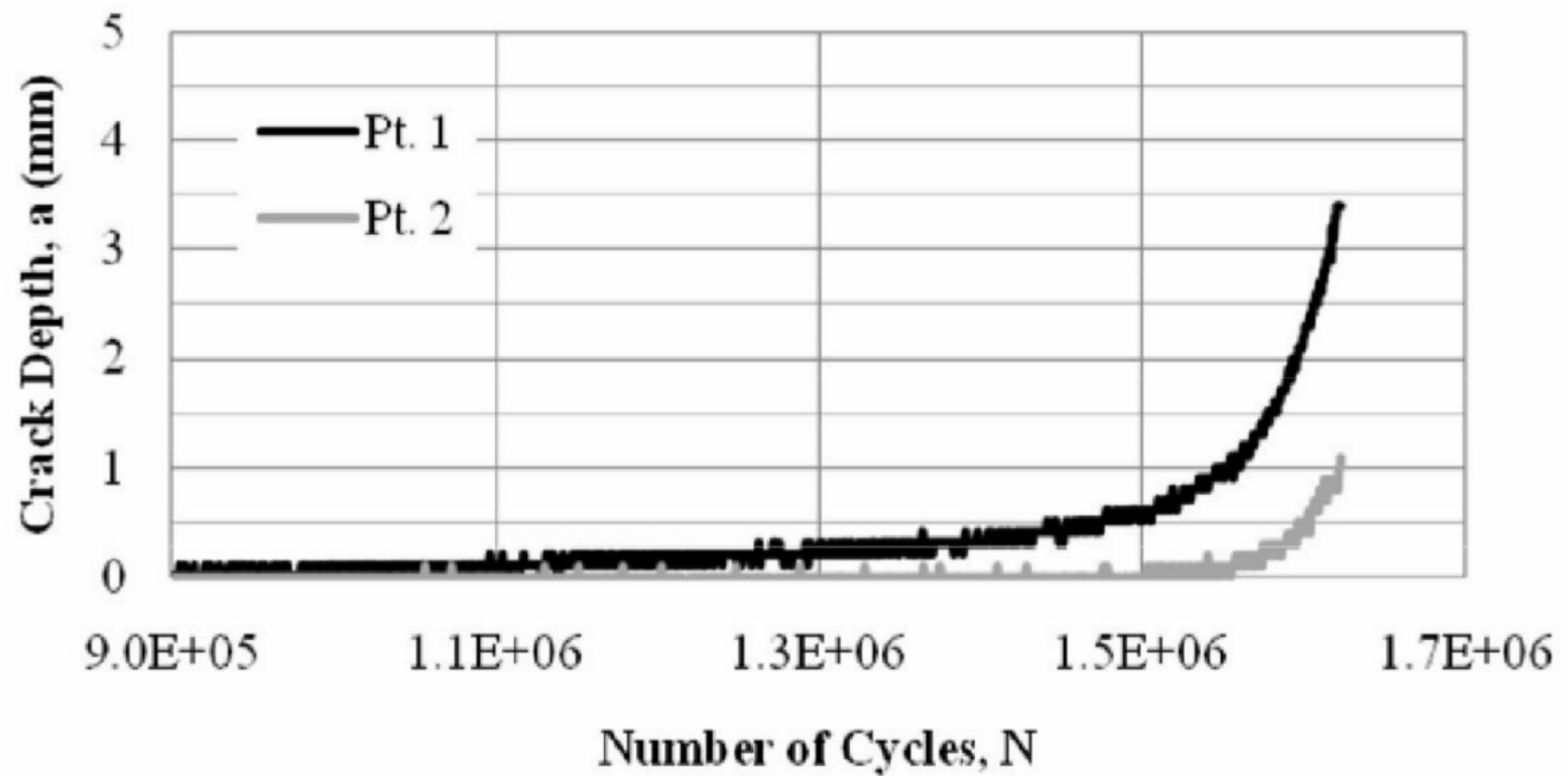


Figure 4.18: Crack depth measurements for as-welded specimen under VA-2 load