M E 325 Exam 1 Problem 2

Group 6

Parker Wilson, Preston Witte, Mike Lawlor, Justin Merkel

For a material with the following properties, plot the elastic and plastic strainamplitudes, ∆εf, verses number of stress reversals, 2Nf using logarithmic axes.The Manson-Coffin equation, relating strain amplitude to number of stress re-versals is:

∆εf/2 = σ′f/E (2Nf)^b + ε′f(2Nf)^c

Where:

•ε′f is the fatigue ductility coefficient and has a value of 0.59

•σ′f is the fatigue strength coefficient and has a value of 277.5 kpsi

•b is the slope of the elastic line and has a value of -0.087

•c is the slope of the plastic line and has a value of -0.58

•E is Young's Modulus of Elasticity and has a value of 30 ×106 psi

Determine:

1. the transition life in reversals

2. the strain amplitude, ∆ε/2 at 50 000 reversals

Plot the strain amplitude on log-log axes

Submit:

•Results generated by the software of your team's choice.

•Along with numerical results, include the symbolic equations used to gen-erate them

•The plot of strain amplitude vs number of reversals. Clearly delineate the

plastic and elastic lines

Clearing command window and workspace

```
clc
clear all
```

Creating vaolues for sigma and epsillon

```
eprime=0.59;
sigmaprime=277500;
```

Constants for Manson Coffin Equation

```
b=-0.087;
c=-0.58;
```

Young's Modulus

```
E=30*10^6;
```

Creating equations to be plotted where N is the number of reversals

```
N=logspace(1,6);
```

Strain Equations

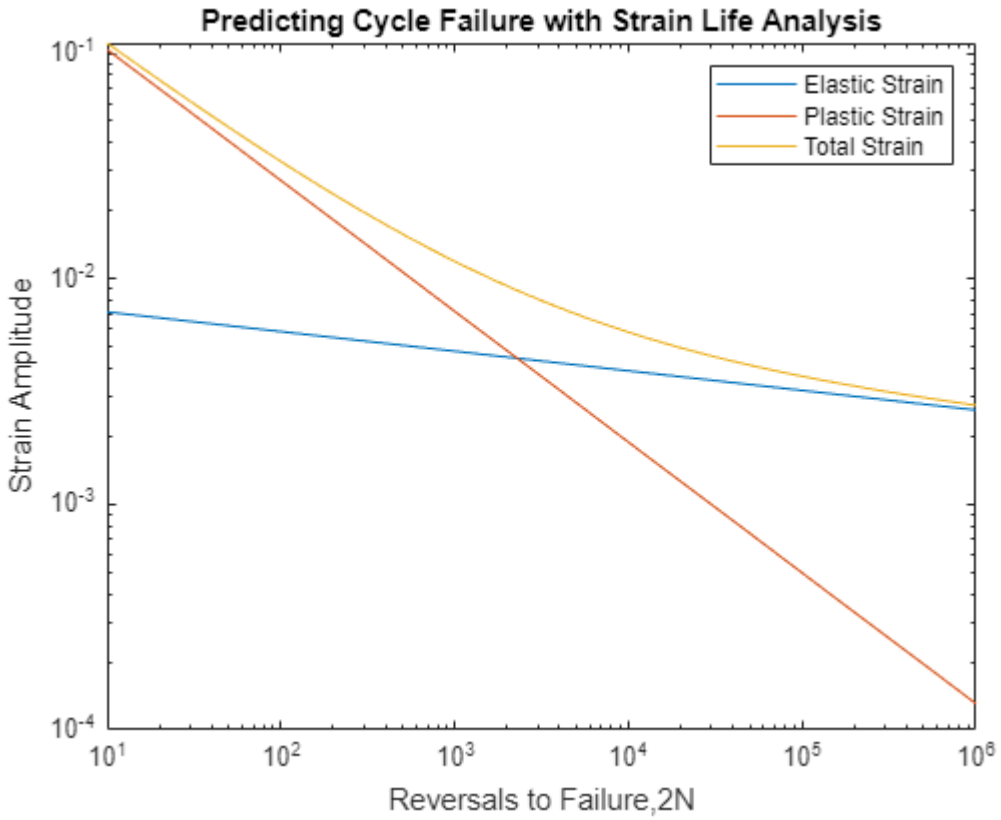
```
ElasticStrain=(sigmaprime/E)*(2*N).^b;
PlasticStrain=eprime*(2*N).^c;

TotalStrain=PlasticStrain+ElasticStrain;

idx = find(abs(ElasticStrain-PlasticStrain)==min(abs(ElasticStrain-PlasticStrain)));
Transition_Life= 2*N(idx);
yvalue=ElasticStrain(idx);
```

Generating a Log-Log graph, with all three strain equations plotted.

```
loglog(N,ElasticStrain,N,PlasticStrain,N,TotalStrain)
legend({'Elastic Strain','Plastic Strain','Total Strain'},'Location','northeast','Orientation',
title('Predicting Cycle Failure with Strain Life Analysis')
xlabel('Reversals to Failure,2N')
ylabel('Strain Amplitude')
```



Calculating the Strain amplitude at 50000 Cycles and displaying results.

```
N=50000;
StrainAmplitude_50000=eprime*(2*N).^c+(sigmaprime/E)*(2*N).^b;

X = sprintf('Strain Amplitude = %s',StrainAmplitude_50000);
disp(X);
```

```
Strain Amplitude = 4.140127e-03
```

```
Y= sprintf('Transition Life = %s Reversals to Failure',Transition_Life);
disp(Y)
```

```
Transition Life = 4.445993e+03 Reversals to Failure
```