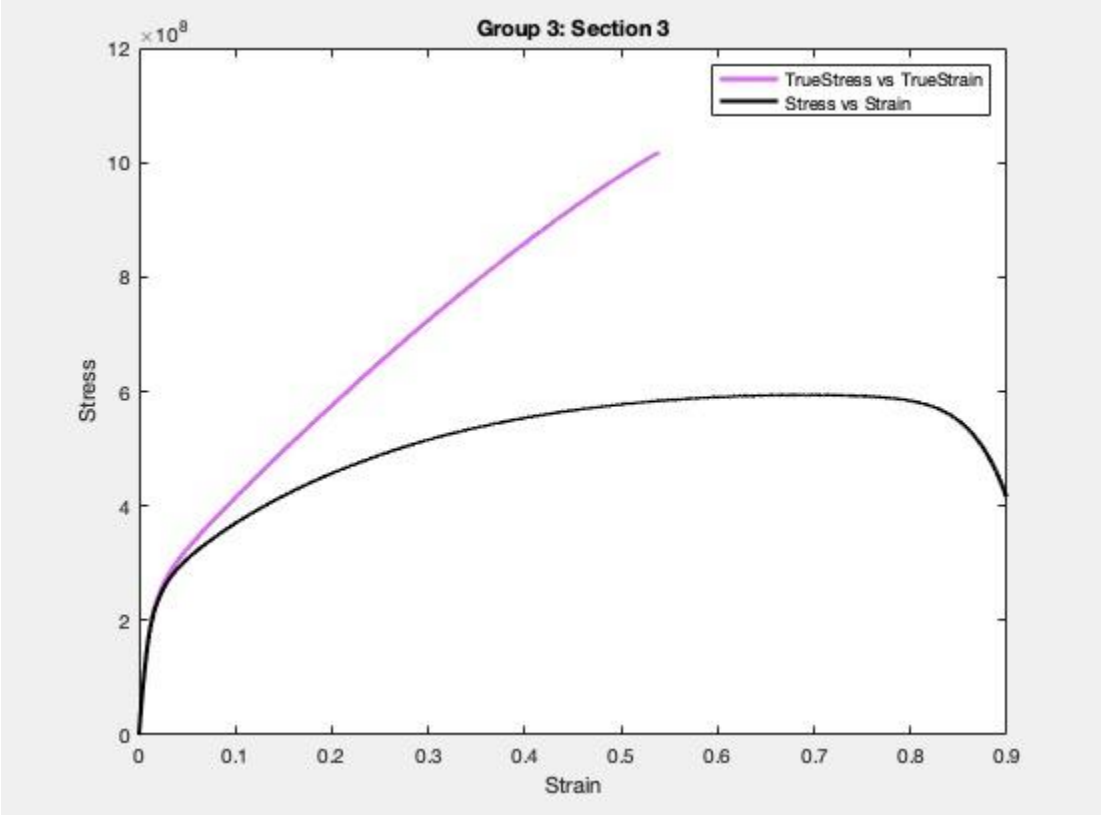
ESO205 Lab-2

SHUBHAM GUPTA 180749 **SEC-3, GROUP-3**

Assignment 1

Plot stress-strain curve and Plot true stress-strain curve till UTS:

UTS = 593.75 MPa



Determine Young's modulus

It is the slope of the stress-strain curve until it is a straight line. For our data, it comes out to be 16.5 GPa. This value of Young's Modulus is comparable with bone(14 GPa), glass-reinforced polyester(17.2 GPa) and lead(13 GPa).

Determine toughness

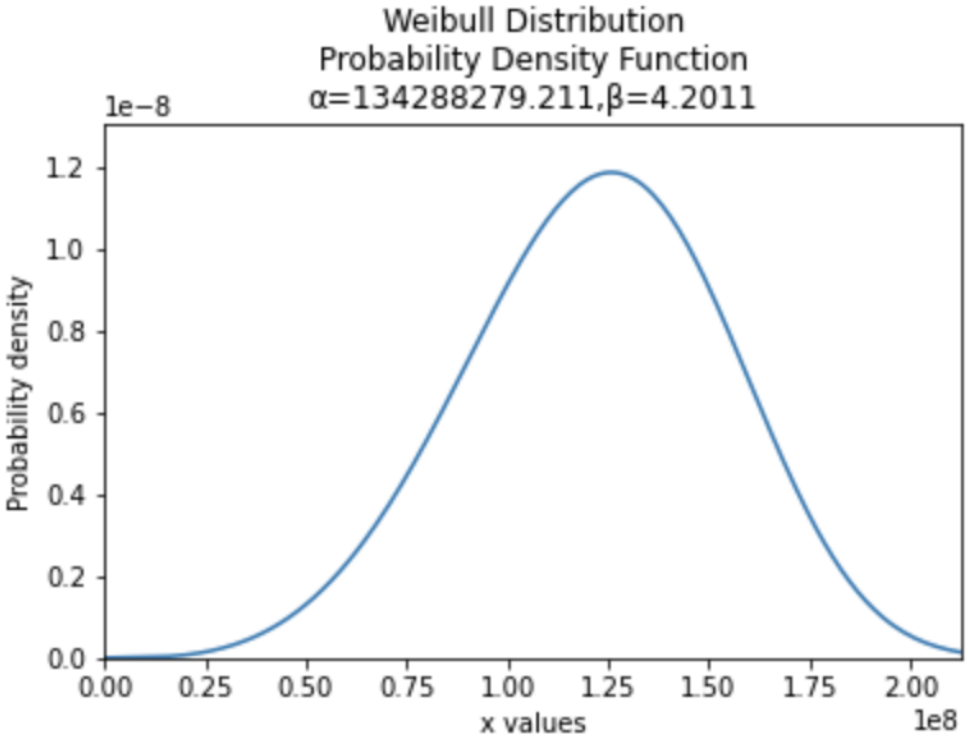
It is the area under the stress-strain curve. For our data, it comes out to be 2.7155e+08 J/m^3.

Assignment 2: Plot Weibull distribution for 3 point bend data

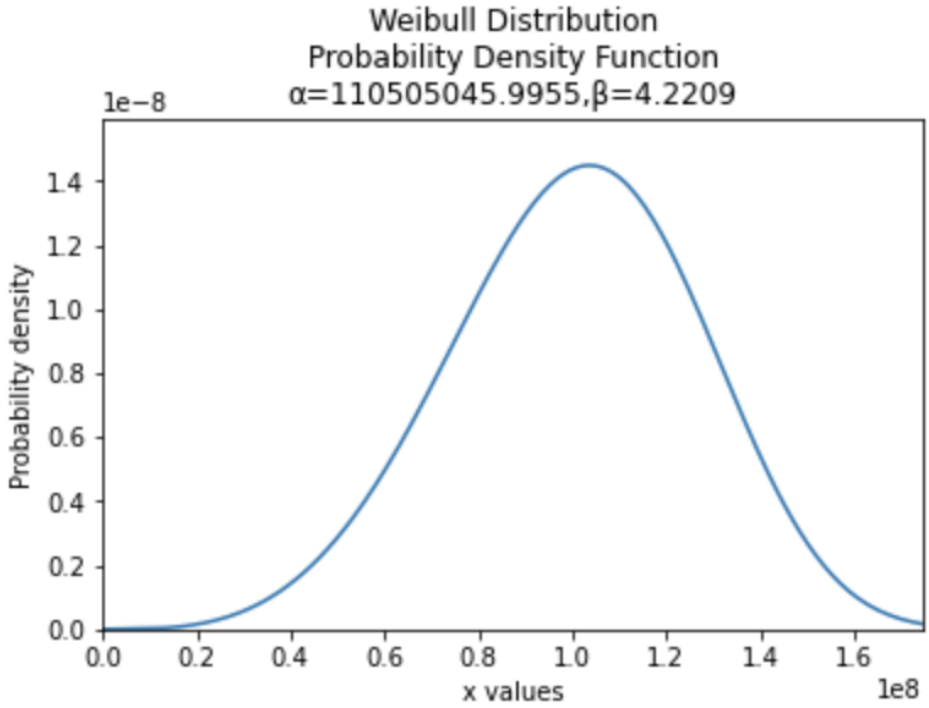
We wrote the following code to plot Weibull distribution for treated and untreated data(mentioned code is for treated data, the only change with the untreated data will be in the 'a' list that denotes maximum load).
We use the estimation of Weibull distribution for this purpose as mentioned in [1].

```
import pandas as pd
import numpy as np
from reliability.Distributions import Weibull_Distribution
import matplotlib.pyplot as plt

a = [83.25, 85, 146.75,107.5,116.666,130.75,178.333, 97.5, 123.25, 90, 141.666,
107.5] ## max load

l = 0.008 (approx. length)
t = 0.0016 (approx. thickness)
w = 0.003 (approx. width)

b = [] ## sigma
for i in a:
    b.append((i*l)/(w*t*t))

df = pd.DataFrame()
df['a'] = a
df['b'] = b

df = df.sort_values('a')

p = [] ## probability of failure
for i in range(len(df['a'])):
    p.append((i+1)/(13))

y = [] ## ln(ln(1/(1-probability of failure)))
for i in p:
    y.append(np.log(np.log(1/(1-i))))

x = [] ## ln(σf)
for i in df['b']:
    x.append(np.log(i))

res = np.polyfit(x,y,1) ## fitting the curve to get slope and intercept
sig = np.exp(-res[1]/res[0]) ## (σ0)
dist = Weibull_Distribution(alpha=134288279.21099243, beta=4.20110887)  # this
created the distribution object
dist.PDF()  # this creates the plot of the PDF
plt.show()
```

Weibull distribution for treated data:



Weibull distribution for untreated data:



Reference:

[1] Ćurković, L., Bakić, A., Kodvanj, J. and Haramina, T., 2010. Flexural strength of alumina ceramics: Weibull analysis. *Transactions of FAMENA*, *34*(1), pp.13-18.