7 October 2021

Input = strain
Output = stress

Young modulus - slope from O to A

Point O = (0, 0)
Point A = (0.01, 43)
Point B = (0.01, 43)
Point C = (0.06, 43.5)
Point D = (0.18, 60)
Point E = (0.27, 51)

Young Modulus = 4300
Plastic Region = 10 (B to C)
Strain Hardening = 137.5 (C to D)
Necking Region = -100 (D to E)

Linear interpolation: ((y2-y1)/(x2-x1))(x-x1)+y1

((43.5 - 43.0)/(0.06-0.01))(strain - 0.01) + 43

If input is in between point __ and ___ :

If strain is in between 0.01 and 0.06:
    Stress = Plastic region * (strain - 0.01) + 43
Elif strain is in between 0.06 and 0.18:
    Stress = Strain hardening * (strain - 0.06) + 43.5
Elif strain is in between 0.18 and 0.27:
    Stress = Necking region * (strain - 0.18) + 60
Elif strain > 0.27a;
    Steel fractured
Elif 0<= strain < 0.01:
    Young modulus * strain

Test cases
Strain = 0.05
Strain = 0.01
Strain = 0.15
Strain = 0.20
Strain = 0.27
Strain = 0.18
Strain = 0.07
Strain = 0.03
Strain = 0.17
Strain = 0.006