6.40 For this problem we first need to convert engineering stresses and strains to true stresses and strains so that the constants K and n in Equation 6.19 may be determined. Since $\sigma_T = \sigma(1 + \varepsilon)$ then,

$$\sigma_{T_1} = (315\ \text{MPa})(1 + 0.105) = 348\ \text{MPa}$$

$$\sigma_{T_2} = (340\ \text{MPa})(1 + 0.220) = 415\ \text{MPa}$$

Similarly for strains, since $\varepsilon_T = \ln(1 + \varepsilon)$ then

$$\varepsilon_{T_1} = \ln\,(1 + 0.105) = 0.09985$$

$$\varepsilon_{T_2} = \ln\,(1 + 0.220) = 0.19885$$

Taking logarithms of Equation 6.19, we get

$$\log \sigma_T = \log K + n \log \varepsilon_T$$

which allows us to set up two simultaneous equations for the above pairs of true stresses and true strains, with K and n as unknowns. Thus

$$\log\,(348) = \log K + n \log\,(0.09985)$$

$$\log\,(415) = \log K + n \log\,(0.19885)$$

Solving for these two expressions yields K = 628 MPa and n = 0.256.

Now, converting ε = 0.28 to true strain

$$\varepsilon_T = \ln\,(1 + 0.28) = 0.247$$

The corresponding σ_T to give this value of ε_T (using Equation 6.19) is just

$$\sigma_T = K\varepsilon_T^n = (628\ \text{MPa})(0.247)^{0.256} = 439\ \text{MPa}$$

Now converting this value of σ_T to an engineering stress using Equation 6.18a gives

$$\sigma = \frac{\sigma_T}{1 + \varepsilon} = \frac{439\ \text{MPa}}{1 + 0.28} = 343\ \text{MPa}$$