ASSIGNMENT #15

8.4 *A polystyrene component must not fail when a tensile stress of 1.25 MPa (180 psi) is applied. Determine the maximum allowable surface crack length if the surface energy of polystyrene is 0.50 J/m^2. Assume a modulus of elasticity of 3.0 GPa (0.435 x 10^6 psi).*

8.7 *Suppose that a wing component on an aircraft is fabricated from an aluminum alloy that has a plane-strain fracture toughness of 40.0 MPa $\sqrt{m}$ (36.4 ksi $\sqrt{in.}$). It has been determined that fracture results at a stress of 365 MPa (53,000 psi) when the maximum internal crack length is 2.5 mm (0.10 in.). For this same component and alloy, compute the stress level at which fracture will occur for a critical internal crack length of 4.0 mm (0.16 in.).*

8.22 *The fatigue data for a brass alloy are given as follows:*

***Stress Amplitude* (*MPa*)**	***Cycles to Failure***
310	2.0×10^5
223	1.0×10^6
191	3.0×10^6
168	1.0×10^7
153	3.0×10^7
143	1.0×10^8
134	3.0×10^8
127	1.0×10^9

(a) Make an S–N plot (stress amplitude versus logarithm of cycles to failure) using these data.

(b) Determine the fatigue strength at 5×10^5 cycles.

(c) Determine the fatigue life for 200 MPa.

8.41 *Steady-state creep rate data are given in the following table for Nickel at 1000°C (1273 K):*

$\dot{\varepsilon}_s$ (h^{-1})	σ [MPa (psi)]

10^{-4}	15 (2175)
10^{-6}	4.5 (650)

If it is known that the activation energy for creep is 272,000 J/mol, compute the steady-state creep rate at a temperature of 850°C (1123 K) and a stress level of 25 MPa (3625 psi).