

Please answer all questions in the homework format listed on the website.

- 1) Dowling, Problem 15.40 (a)-(d)
- 2) Use the creep-rupture data for heat resistant steel given in Table P15.21 on page 842. The chromium is used in this steel to increase resistance to corrosion and oxidation, to impart high temperature strength and to increase its capability to be hardened by heat treatment (“hardenability”). The molybdenum addition also imparts higher hardenability and increases high temperature tensile and creep strengths. The vanadium addition inhibits grain growth during heat treating while improving strength and toughness.
  - a. Consider the Sherby-Dorn parameter  $P_{SD}$  for the data. Let  $Q = 110,000$  cal/mol. Use Matlab’s POLYVAL and POLYFIT functions to find the coefficients  $a_0$ ,  $a_1$ ,  $a_2$ , and  $a_3$  in equation 15.17(a). Plot the polynomial fit alongside the steel data as in Figure 15.21. Make sure you submit your code with comments to receive full credit.
  - b. Consider the Larson-Miller parameter  $P_{LM}$  for the data. Let  $C = 22 \log(\text{hours})$ . Find the coefficients  $b_0$ ,  $b_1$ ,  $b_2$ , and  $b_3$  in equation 15.16(b). Plot the polynomial fit alongside the data as in Figure 15.23. How do your values compare with those listed in Table 15.3?
  - c. If a component subjected to 425 MPa at 440°C has a desired service life of 50 years, what are the safety factors in life, safety margins in temperature, and safety factors in stress for Sherby-Dorn and Larson-Miller?