

## 530.215 MECHANICS-BASED DESIGN

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### Homework VII

Due April 8, 2009

1. Juvinal, Problem 3.6
2. Juvinal, Problem 3.7
3. Juvinal, Problem 3.9
4. Juvinal, Problem 3.12
5. Juvinal, Problem 3.14D
6. Juvinal, Problem 6.20
7. Juvinal, Problem 6.22
8. Juvinal, Problem 6.27
9. A specimen of medium-carbon steel having an initial diameter of 0.503 in was tested in tension using a gauge length of 2 in. The following data were obtained for the elastic and plastic states (Note that there is some overlap in the data). Plot the engineering or nominal stress-strain diagram using two scales for the unit strain  $\epsilon$ , one from zero to about 0.02 in/in and the other from zero to maximum strain. From this diagram find the modulus of elasticity, the yield strength (0.2 percent offset), the ultimate strength, and percent reduction in the area.

Elastic State		Plastic State	
Load $P$ , lbf	Elongation, in	Load $P$ , lbf	Area $A_i$ , in <sup>2</sup>
1 000	0.0004	8 800	0.1984
2 000	0.0006	9 200	0.1978
3 000	0.0010	9 100	0.1963
4 000	0.0013	13 200	0.1924
7 000	0.0023	15 200	0.1875
8 400	0.0028	17 000	0.1563
8 800	0.0036	16 400	0.1307
9 200	0.0089	14 800	0.1077

10. Compute the true stress and the logarithmic strain using the data of Prob. 9 and plot the results on log-log scale. Then find the plastic strength coefficient  $\sigma_0$  and the strength-strengthen exponent  $m$ . Find also the yield strength and ultimate strength after the specimen has had 20 percent cold work.