Mechanical Behavior of Materials 5th edition Dowling Solutions Manual

SKU: 9780134606545-SOLUTIONS

1.5

A plate with a width change as in Fig A.11(c) is subjected to a given force in tension and has given dimensions. It is made of a ductile polycarbonate plastic with a given yield strength. What is the safety factor against large amounts of deformation due to yielding? Does the value seem adequate?

P	w_2	w_1	ρ	t	σ_o
N	mm	mm	mm	mm	MPa
2800	24	16	4.0	6.0	62

$$S = \frac{P}{w_1 t}, \quad X_1 = \frac{\sigma_o}{S}$$

S	X_1
MPa	
29.2	**2.13**

Units for S: N/mm^2 = MPa

The safety factor seems reasonable. Note that the quite ductile polycarbonate can deform by a large amount before failing.

1.6

A shaft with a circumferential groove as in Fig A.12(c) is subjected to a given bending moment and has given dimensions. It is made of a ductile titanium alloy with a given yield strength. What is the safety factor against large amounts of deformation due to yielding? Does the value seem adequate?

M	d_2	d_1	ρ	σ_o
N·mm	mm	mm	mm	MPa
250,000	22	18	2.0	830

$$S = \frac{32M}{\pi d_1^3}, \quad X_1 = \frac{\sigma_o}{S}$$

S	X_1
MPa	
436.6	**1.90**

Units for S: N/mm^2 = MPa

The safety factor seems adequate. Note that the ductile titanium alloy can deform by a large amount before failing.

Answers for Problems and Questions

INSTRUCTOR'S SUPPLEMENT

The pages that follow give the answers for Problems and Questions where a numerical value or the development of a new equation is requested. Where a series of values needs to be calculated, a typical set of these is given. Approximately half of these answers are the same as those given in the textbook itself.

This supplement is not intended for distribution as a unit to students. Of course, it may be useful to provide students with answers for individual problems from this listing.

CHAPTER 1

1.5 $X_1 = 2.13$
1.6 $X_1 = 1.90$

CHAPTER 3

3.4 **(a)** For $P = 7.22\,\text{kN}$: $\sigma = 111.7\,\text{MPa}$, $\varepsilon = 0.001652$; **(b)** $\sigma_o = 530\,\text{MPa}$; **(c)** $P_{o2} = 166.5\,\text{kN}$

3.5 **(a)** $E = 68.8\,\text{GPa}$; **(b)** $\varepsilon_p = 0.01698$; **(c)** $L_A = 150.71\,\text{mm}$, $L_0 = 150.00\,\text{mm}$; **(d)** $L_B = 153.78\,\text{mm}$, $L_0 = 152.55\,\text{mm}$

3.6 $E = 206.2\,\text{GPa}$, $\sigma_o = 831\,\text{MPa}$, $\sigma_u = 918\,\text{MPa}$, $100\varepsilon_f = 20.4\%$, $100\varepsilon_{pf} = 20.1\%$, $\%RA = 62.6\%$

3.7 $E = 71.5\,\text{GPa}$, $\sigma_o = 301\,\text{MPa}$, $\sigma_u = 323\,\text{MPa}$, $100\varepsilon_f = 14.6\%$, $100\varepsilon_{pf} = 14.3\%$, $\%RA = 56.5\%$

3.8 $E = 97.7\,\text{GPa}$, $\sigma_o = 179\,\text{MPa}$, $\sigma_u = 240\,\text{MPa}$, $100\varepsilon_f = 1.17\%$, $100\varepsilon_{pf} = 0.93\%$, $\%RA = 1.86\%$

3.9 $E = 201.3\,\text{GPa}$, $\sigma_o = 1400\,\text{MPa}$, $\sigma_u = 1492\,\text{MPa}$, $100\varepsilon_f = 9.40\%$, $100\varepsilon_{pf} = 8.86\%$, $\%RA = 38.0\%$

3.10 $E = 68.7\,\text{GPa}$, $\sigma_o = 528\,\text{MPa}$, $\sigma_u = 597\,\text{MPa}$, $100\varepsilon_f = 15.3\%$, $100\varepsilon_{pf} = 14.5\%$, $\%RA = 26.4\%$

3.11 $E = 166.1\,\text{GPa}$, $\sigma_o = 418\,\text{MPa}$, $\sigma_u = 490\,\text{MPa}$, $100\varepsilon_f = 1.154\%$, $100\varepsilon_{pf} = 0.859\%$

3.12 $E_t = 3530\,\text{MPa}$, $\sigma_{ou} = 55.9\,\text{MPa}$, $\sigma_u = 55.9\,\text{MPa}$, $100\varepsilon_f = 55.9\%$ (estimate), $100\varepsilon_{pf} = 55.0\%$, $\%RA = 60.3\%$