

- 4-18  $y_{\max} = -0,34 \text{ mm}$   
 4-20  $z_A = 0,94 \text{ mm}, z_B = -0,59 \text{ mm}$   
 4-26 Use  $d = 35 \text{ mm}$   
 4-30  $y_B = -1,2 \text{ mm}$   
 4-37  $y_A = -2,06 \text{ mm}, y_{x=500 \text{ mm}} = -2,135 \text{ mm}$   
 4-46  $y_A = -7,4 \text{ mm}$   
 4-49  $y_{x=0,2 \text{ m}} = -2,7 \text{ mm}$   
 4-52 (a)  $\sigma_b = 522 \text{ MPa}, \sigma_c = -123 \text{ MPa}$ ,  
 (b)  $\sigma_b = 534,7 \text{ MPa}, \sigma_c = -110,3 \text{ MPa}$   
 4-58  $R_O = 15,6 \text{ kN}, R_C = 4,4 \text{ kN}$  ambos na  
 mesma direção  
 4-61  $\sigma_{BE} = 140 \text{ MPa}, \sigma_{DF} = 71,2 \text{ MPa}$ ,  
 $y_B = -0,670 \text{ mm}, y_C = -2,27 \text{ mm}$ ,  
 $y_D = -0,339 \text{ mm}$   
 4-66  $\delta_A = (\pi + 4)PR^3 / (4EI), \delta_B = \pi PR^3 / (4EI)$   
 4-69  $\delta = 0,476 \text{ mm}$   
 4-75  $t = 12 \text{ mm}$ , (b) não  
 4-83  $y_{\max} = 2k_1a / (k_1 + k_2)$

## B-5 Capítulo 5

- 5-2 (a) MSS:  $n = 4,17$ , DE:  $n = 4,17$ , (b) MSS:  
 $n = 4,17$ , DE:  $n = 4,81$ , (c) MSS:  $n = 2,08$ , DE:  
 $n = 2,41$ , (d) MSS:  $n = 4,17$ , DE:  $n = 4,81$   
 5-3 (a) MSS:  $n = 2,17$ , DE:  $n = 2,50$ , (b) MSS:  
 $n = 1,45$ , DE:  $n = 1,56$ , (c) MSS:  $n = 1,52$ , DE:  
 $n = 1,65$ , (d) MSS:  $n = 1,27$ , DE:  $n = 1,50$   
 5-9 (a) DE:  $\sigma' = 86 \text{ MPa}, n = 3,42$   
 5-10 (a) DCM:  $\sigma_A = 63 \text{ MPa}, \sigma_C = 0, \sigma_B = -35 \text{ MPa}$ ,  
 $n = 1,77$   
 5-12 (a) MNS:  $n = 3,89$   
 5-13 (a)  $\sigma_A = \sigma_B = 140 \text{ MPa}, r = 1, n = 1,5$   
 5-20  $(\sigma_t)_{\max} = 114,9 \text{ MPa}, \sigma_1 = 56,6 \text{ MPa}$ ,  
 $\sigma_r = -3,5 \text{ MPa}, \sigma' = 102,5 \text{ MPa}, n = 3,87$   
 5-23 Usando BCM, selecione  $d = 35 \text{ mm}$   
 5-27  $d = 18 \text{ mm}$   
 5-34 (a)  $\delta = 0,0125 \text{ mm}, p = 24,3 \text{ MPa}$   
 $(\sigma_t)_i = -40,5 \text{ MPa}, (\sigma_r)_i = -24,3 \text{ MPa}$ ,  
 $(\sigma_t)_o = -63,2 \text{ MPa}, (\sigma_r)_o = -24,3 \text{ MPa}$   
 5-38  $n_o = 2,8, n_i = 2,47$   
 5-43  $p = 29,2 \text{ MPa}$

## B-6 Capítulo 6

- 6-1  $S_e = 600 \text{ MPa}$   
 6-3  $S'_e = 231,5 \text{ MPa}, \sigma'_F = 786,6 \text{ MPa}, b =$   
 $-0,08426, f = 0,8954, a = 829 \text{ MPa}$ ,  
 $S_f = 374,6 \text{ MPa}, N = 1\,320\,770 \text{ ciclos}$   
 6-5  $(S_f)_{\text{ax}} = 1134N^{-0,0851} \text{ MPa}, 10^3 \leq N \leq 10^6 \text{ ciclos}$   
 6-6  $S_e = 241 \text{ MPa}$   
 6-10  $S'_e = 220 \text{ MPa}, k_a = 0,899, k_b = 1, k_c = 0,85$ ,  
 $S_e = 168 \text{ MPa}, K_t = 2,5, K_f = 2,28$ ,  
 $F_a = 19,7 \text{ kN}, F_y = 98,7 \text{ kN}$   
 6-12 Escoamento:  $n_y = 1,67$ . Fadiga: (a)  $n_f = 1,06$ ,  
 (b)  $n_f = 1,31$ , (c)  $n_f = 1,32$   
 6-17  $n_y = 4,68$  (a)  $n_f = 2,02$ , (b)  $n_f = 2,1$   
 6-23 No filete  $n_f = 1,38$   
 6-24 (a)  $T = 3,22 \text{ N} \cdot \text{m}$ , (b)  $T = 3,96 \text{ N} \cdot \text{m}$   
 (c)  $n_y = 1,91$   
 6-27 (a)  $P_{\text{all}} = 16,0 \text{ kN}, n_y = 5,73$ , (b)  $P_{\text{all}} = 51,0$   
 $\text{kN}, n_y = 3,90$   
 6-29 (a) 24900 ciclos, (b) 27900 ciclos  
 6-34 Admitido rotação  $S'_e = 389,6 \text{ LN}(1,0,138)$   
 $\text{MPa}, k_a = 0,765 \text{ LN}(1, 0,058), k_b = 0,881, S_e =$   
 $262,6 \text{ LN}(1, 0,150) \text{ MPa}, k_f = 1,599 \text{ LN}(1, 0,15)$ ,  
 $\sigma = 160 \text{ LN}(1, 0,15) \text{ MPa}, z = -2,15$ ,  
 $R = 0,9842$

## B-7 Capítulo 7

- 7-1 (a) DE-Gerber  $d = 24,6 \text{ mm}$ , (b) DE-Eliptico  
 $d = 24,56 \text{ mm}$ , (c) DE-Soderberg:  $d = 26,5 \text{ mm}$ ,  
 (d) DE-Goodman:  $d = 26,03 \text{ mm}$   
 7-2 Usando De-Eliptico:  $d = 24 \text{ mm}, D = 32 \text{ mm}$ ,  
 $r = 1,6 \text{ mm}$   
 7-14 (a)  $\omega = 883 \text{ rads/s}$  (b)  $d = 50 \text{ mm}$   
 (c)  $\omega = 1767 \text{ rad/s}$  (duplica)  
 7-16 (b)  $\omega = 437 \text{ rad/s}$   
 7-20  $d_{\min} = 45043 \text{ mm}, d_{\max} = 45,059 \text{ mm}$ .  
 $D_{\min} = 45000 \text{ mm}, D_{\max} = 45,025 \text{ mm}$   
 7-24 (a)  $d_{\min} = 40,043 \text{ mm}, d_{\max} = 40,059 \text{ mm}$ ,  
 $D_{\min} = 40 \text{ mm}, D_{\max} = 40,025$   
 (b)  $p_{\min} = 25,9 \text{ Mpa}, P_{\max} = 84,8 \text{ MPa}$ ,  
 (c) Eixo:  $n = 4,8$ , cubo:  $n = 1,5$   
 (d) Supondo  $f = 0,3, T = 310,8 \text{ N} \cdot \text{m}$