MASSACHUSETTS INSTITUTE OF TECHNOLOGY

13.10J/1.573J/13.014/1.052

Problem Set 10

Assign : Nov. 7, 2000 (for 13.014/1.052)
Nov. 8, 2000 (for 13.10J/1.573J)
Due : Nov. 14, 2000 (for 13.014/1.052)
Nov. 15, 2000 (for 13.10J/1.573J)

For undergraduates : 14.3, 14.39 and 14.58

For graduates : 14.58, 14.69 and the problems below.

1. A slender curved circular cross section bar AB with radius of cross section r is welded to the straight cylindrical bar BC with the same radius of cross section as in Figure 1. Young's modulus of elasticity is E for both bars. AB is a quarter of the circle with radius of R. The free end is subjected to a horizontal force P. Determine the horizontal and vertical deflections δ_h, δ_v and the angle of rotation θ at the free end. Work with differential equations.

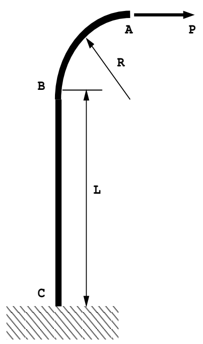


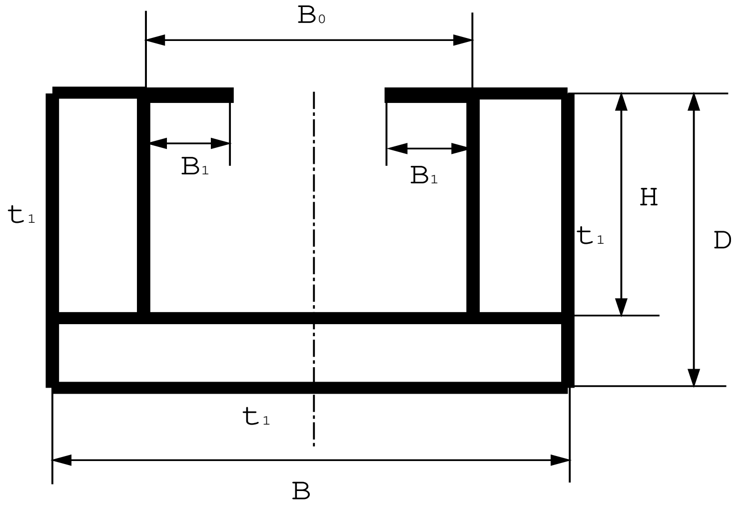
Figure 1: A diagram for problem 1

2. A typical cross section of an idealized ship is shown in Figure 2. If the ship is subjected to a torque of $2 \times 10^6 N \cdot m$ about the longitudinal axis, compute

(a) the shear stress distribution on the cross section.

(b) the magnitude and location of maximum shear stress.

Here, the shear modulus is $G = 1 \times 10^{11} Pa$.



$B = 25m$ $\quad D = 15m$ $\quad H = 10m$

$B_0 = 15m$ $\quad t_1 = 20mm$ $\quad t_2 = 16mm$

$B_1 = 3m$

The thickness is t_2 unless mentioned.

Figure 2: A diagram for problem 2