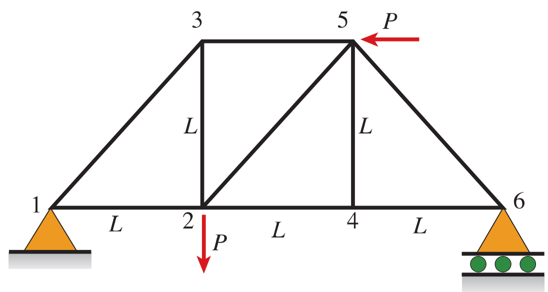
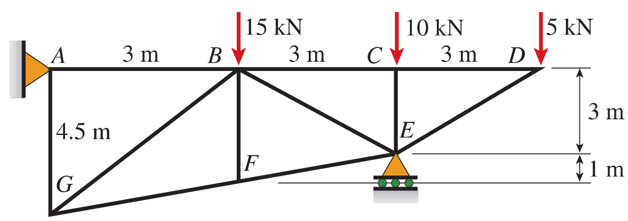
A-1.1: A plane truss has downward applied load P at joint 2 and another load P applied leftward at joint 5. The force in member 3–5 is:

(A) 0
(B) $-P/2$
(C) $-P$
(D) $+1.5\ P$



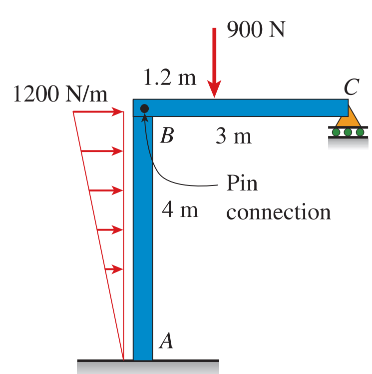
A-1.2: The force in member FE of the plane truss below is approximately:

(A) -1.5 kN
(B) -2.2 kN
(C) 3.9 kN
(D) 4.7 kN



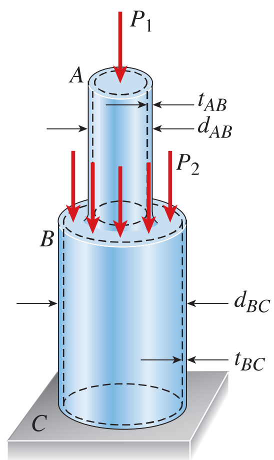
A-1.3: The moment reaction at A in the plane frame below is approximately:

(A) $+1400\ \mathrm{N \cdot m}$
(B) $-2280\ \mathrm{N \cdot m}$
(C) $-3600\ \mathrm{N \cdot m}$
(D) $+6400\ \mathrm{N \cdot m}$



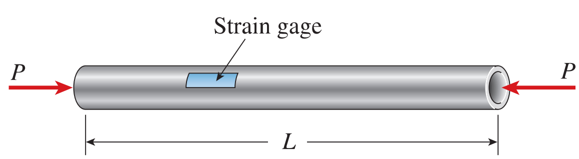
A-1.4: A hollow circular post ABC (see figure) supports a load $P_1 = 16$ kN acting at the top. A second load P_2 is uniformly distributed around the cap plate at B. The diameters and thicknesses of the upper and lower parts of the post are $d_{AB} = 30$ mm, $t_{AB} = 12$ mm, $d_{BC} = 60$ mm, and $t_{BC} = 9$ mm, respectively. The lower part of the post must have the same compressive stress as the upper part. The required magnitude of the load P_2 is approximately:

(A) 18 kN
(B) 22 kN
(C) 28 kN
(D) 46 kN



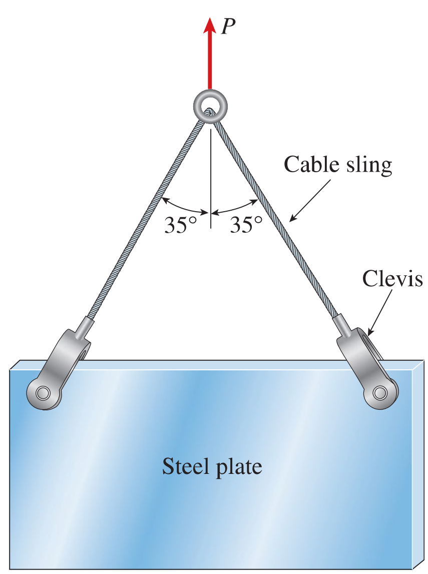
A-1.5: A circular aluminum tube of length $L = 650$ mm is loaded in compression by forces P. The outside and inside diameters are 80 mm and 68 mm, respectively. A strain gage on the outside of the bar records a normal strain in the longitudinal direction of 400×10^{-6}. The shortening of the bar is approximately:

(A) 0.12 mm
(B) 0.26 mm
(C) 0.36 mm
(D) 0.52 mm



A-1.6: A steel plate weighing 27 kN is hoisted by a cable sling that has a clevis at each end. The pins through the clevises are 22 mm in diameter. Each half of the cable is at an angle of 35° to the vertical. The average shear stress in each pin is approximately:

(A) 22 MPa
(B) 28 MPa
(C) 40 MPa
(D) 48 MPa



A-1.7: A steel wire hangs from a high-altitude balloon. The steel has unit weight 77 kN/m^3 and yield stress of 280 MPa. The required factor of safety against yield is 2.0. The maximum permissible length of the wire is approximately:

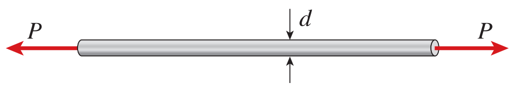
(A) 1800 m
(B) 2200 m
(C) 2600 m
(D) 3000 m

A-1.8: An aluminum bar (E = 72 GPa, ν = 0.33) of diameter 50 mm cannot exceed a diameter of 50.1 mm when compressed by axial force P. The maximum acceptable compressive load P is approximately:

(A) 190 kN
(B) 200 kN
(C) 470 kN
(D) 860 kN

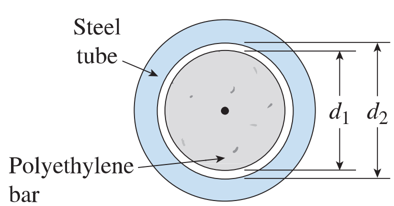
A-1.9: An aluminum bar (E = 70 GPa, ν = 0.33) of diameter 20 mm is stretched by axial forces P, causing its diameter to decrease by 0.022 mm. The load P is approximately:

(A) 73 kN
(B) 100 kN
(C) 140 kN
(D) 339 kN



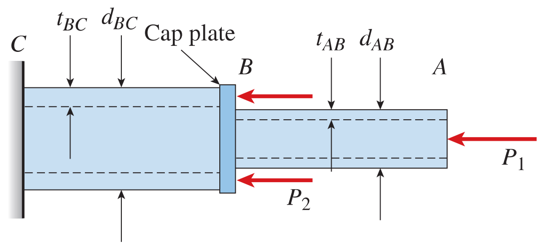
A-1.10: An polyethylene bar (E = 1.4 GPa, ν = 0.4) of diameter 80 mm is inserted in a steel tube of inside diameter 80.2 mm and then compressed by axial force P. The gap between steel tube and polyethylene bar will close when compressive load P is approximately:

(A) 18 kN
(B) 25 kN
(C) 44 kN
(D) 60 kN



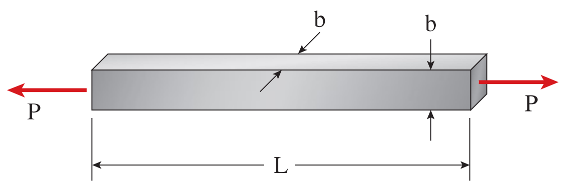
A-1.11: A pipe (E = 110 GPa) carries a load P_1 = 120 kN at A and a uniformly distributed load P_2 = 100 kN on the cap plate at B. Initial pipe diameters and thicknesses are d_{AB} = 38 mm, t_{AB} = 12 mm, d_{BC} = 70 mm, and t_{BC} = 10 mm. Under loads P_1 and P_2, wall thickness t_{BC} increases by 0.0036 mm. Poisson's ratio ν for the pipe material is approximately:

(A) 0.27
(B) 0.30
(C) 0.31
(D) 0.34



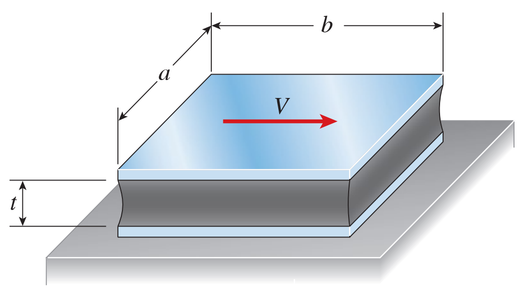
A-1.12: A titanium bar (E = 100 GPa, ν = 0.33) with square cross section (b = 75 mm) and length L = 3.0 m is subjected to tensile load P = 900 kN. The increase in volume of the bar is approximately:

(A) 1400 mm^3
(B) 3500 mm^3
(C) 4800 mm^3
(D) 9200 mm^3



A-1.13: An elastomeric bearing pad is subjected to a shear force V during a static loading test. The pad has dimensions a = 150 mm and b = 225 mm, and thickness t = 55 mm. The lateral displacement of the top plate with respect to the bottom plate is 14 mm under a load P = 16 kN. The shear modulus of elasticity G of the elastomer is approximately:

(A) 1.0 MPa
(B) 1.5 MPa
(C) 1.7 MPa
(D) 1.9 MPa



A-1.14: A bar of diameter d = 18 mm and length L = 0.75 m is loaded in tension by forces P. The bar has modulus E = 45 GPa and allowable normal stress of 180 MPa. The elongation of the bar must not exceed 2.7 mm. The allowable value of forces P is approximately:

(A) 41 kN
(B) 46 kN
(C) 56 kN
(D) 63 kN