

國立中央大學八十五學年度碩士班研究生入學試題卷

所別：機械工程研究所 甲組

科目：材料力學

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- A composite shaft with a length of 0.25 m is made by shrink fitting a steel tube over a brass core (see Fig. 1). The shear modulus of elasticity of the tube is $G_s = 80$ GPa and of the core is $G_b = 40$ GPa. The outside diameters are $d_1 = 30$ mm for the core and $d_2 = 50$ mm for the tube. The angle of twist is 10 degrees. Calculate the maximum shear stresses τ_s and τ_b in the steel and brass, respectively, due to an applied torque. (25%)
- An angle section with dimensions shown in Fig. 2 is acted upon by a moment of 1 kN·m. Determine the location of the neutral axis and the maximum bending stress. (25%)
- The beam shown in Fig. 3 has a constant EI . Determine the reactions at supports and the deflection of the beam. (25%)
- The round bar shown in Fig. 4 has length $L = 2000$ mm and diameter $d = 50$ mm. It is fixed at the left end, and subjected to an axial load P combined with a torque T at its free end. These loads cause the bar to shorten in length by an amount $\Delta L = 1.20$ mm and increase in diameter by an amount $\Delta d = 0.010$ mm, and cause the free end to rotate through an angle of 2.75° .

 - Determine the principal strains and maximum shear strain at points on the surface of the bar. (15%)
 - Determine the corresponding principal stresses and maximum shear stress if Young's modulus is $E = 70$ GPa and Poisson's ratio is $\nu = 0.3$. (10%)

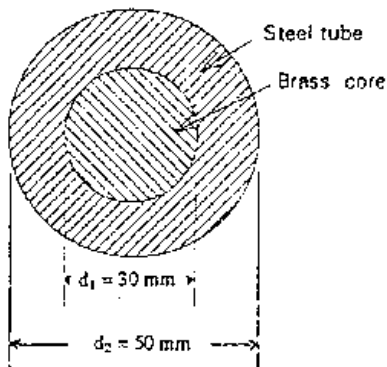


Fig. 1

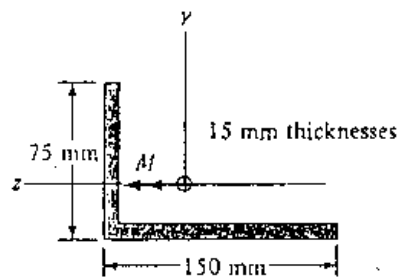


Fig. 2

參考冊

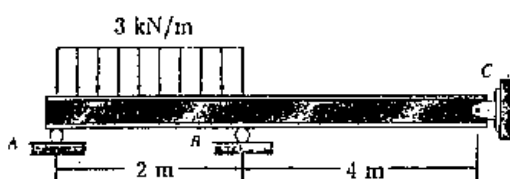


Fig. 3

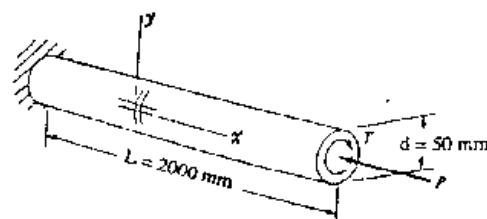


Fig. 4