

Chapter 5

Energy methods

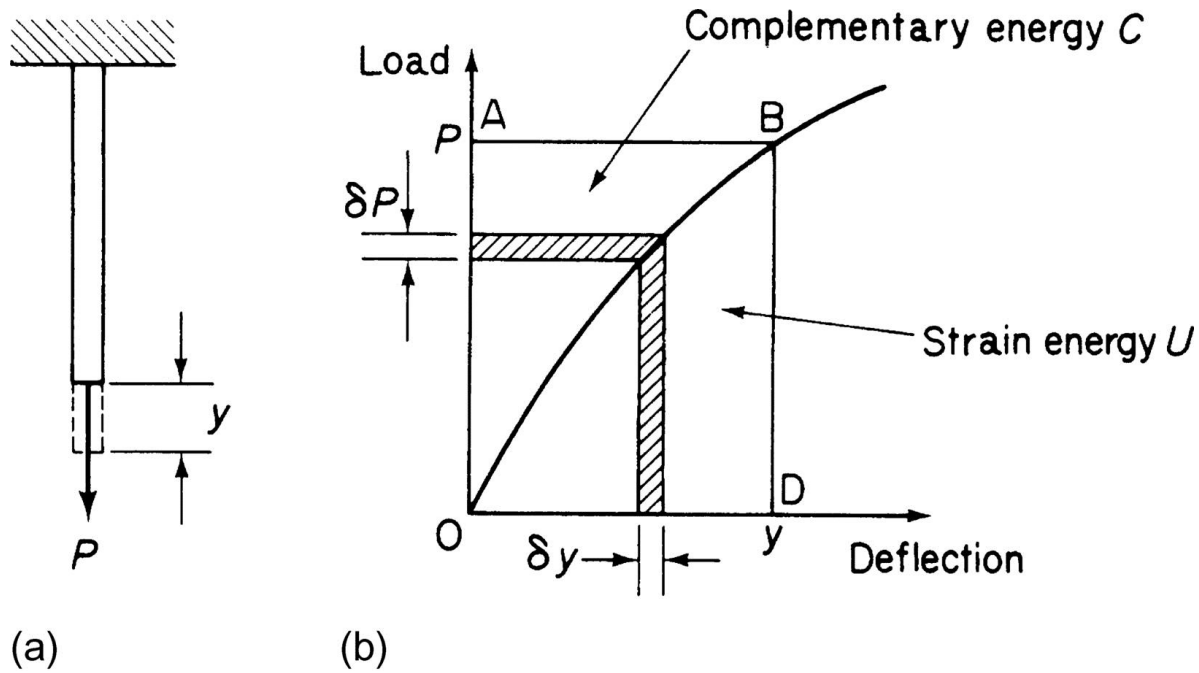


FIGURE 5.1 (a) Strain Energy of a Member Subjected to Simple Tension; (b) Load–Deflection Curve for a Nonlinearly Elastic Member

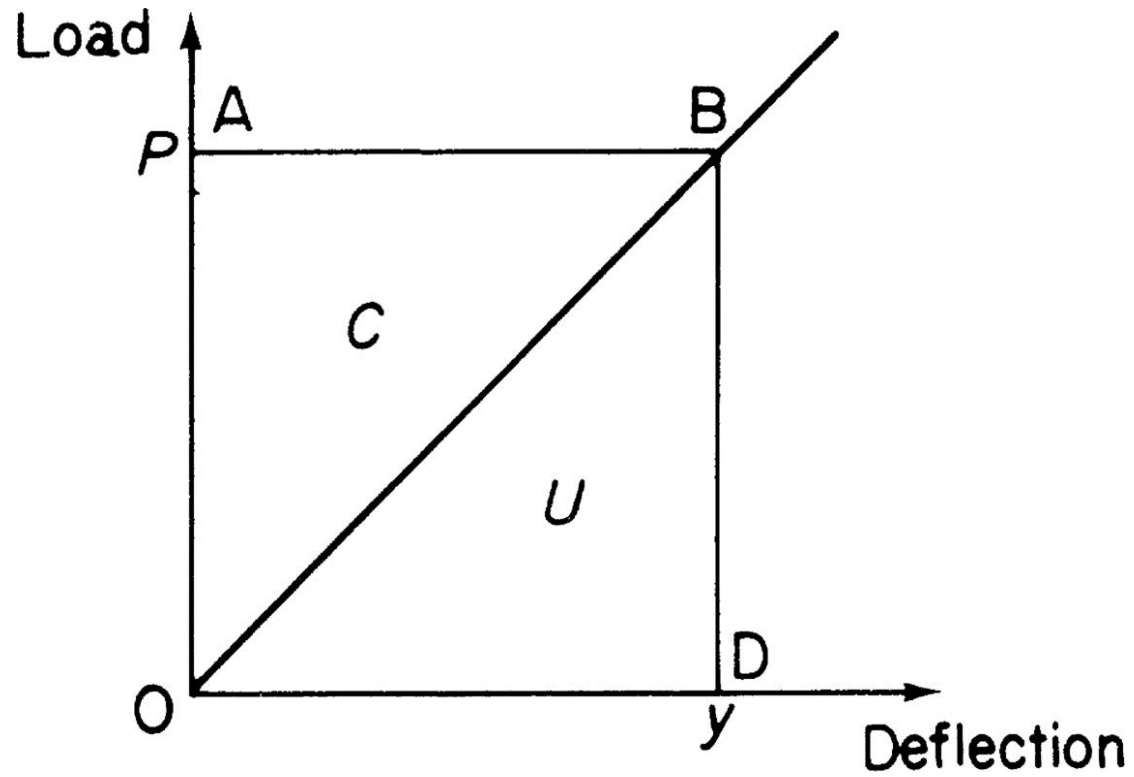


FIGURE 5.2 Load–Deflection Curve for a Linearly Elastic Member

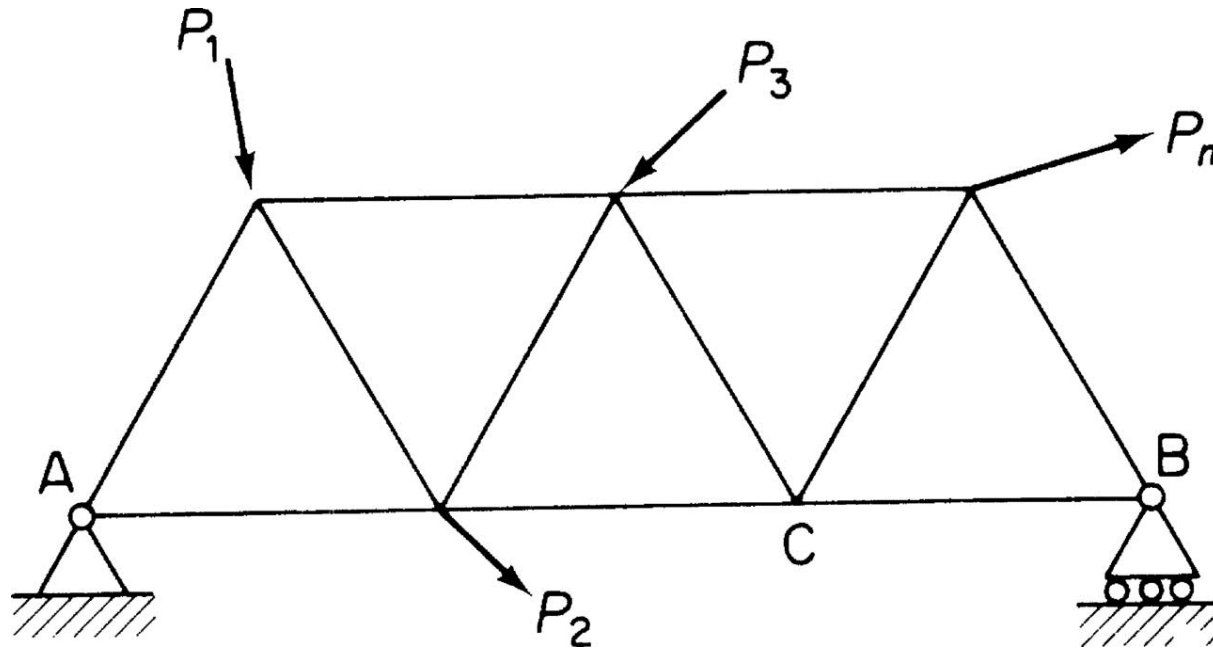


FIGURE 5.3 Determination of the Deflection of a Point on a Framework by the Method of Complementary Energy

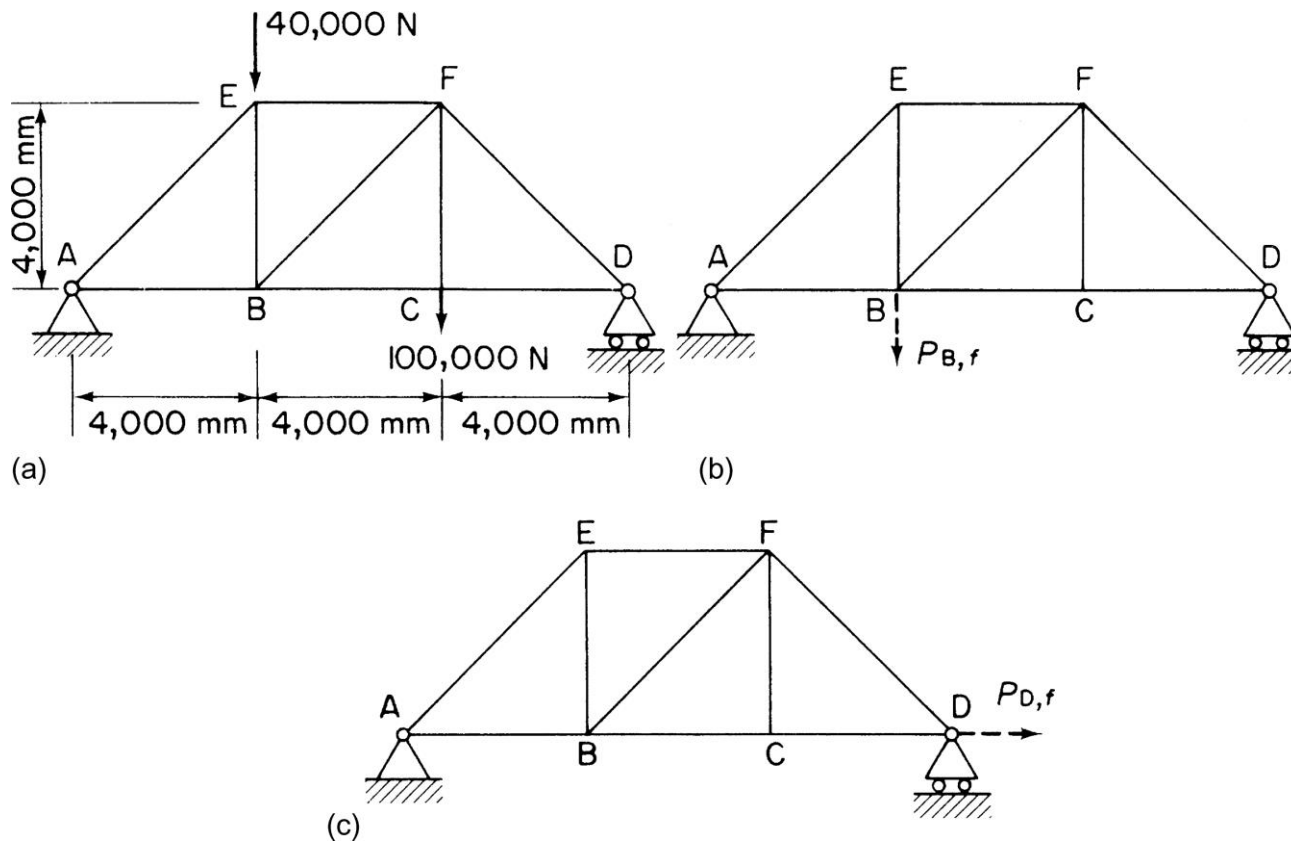


FIGURE 5.4 (a) Actual Loading of Framework; (b) Determination of Vertical Deflection of B; (c) Determination of Horizontal Deflection of D

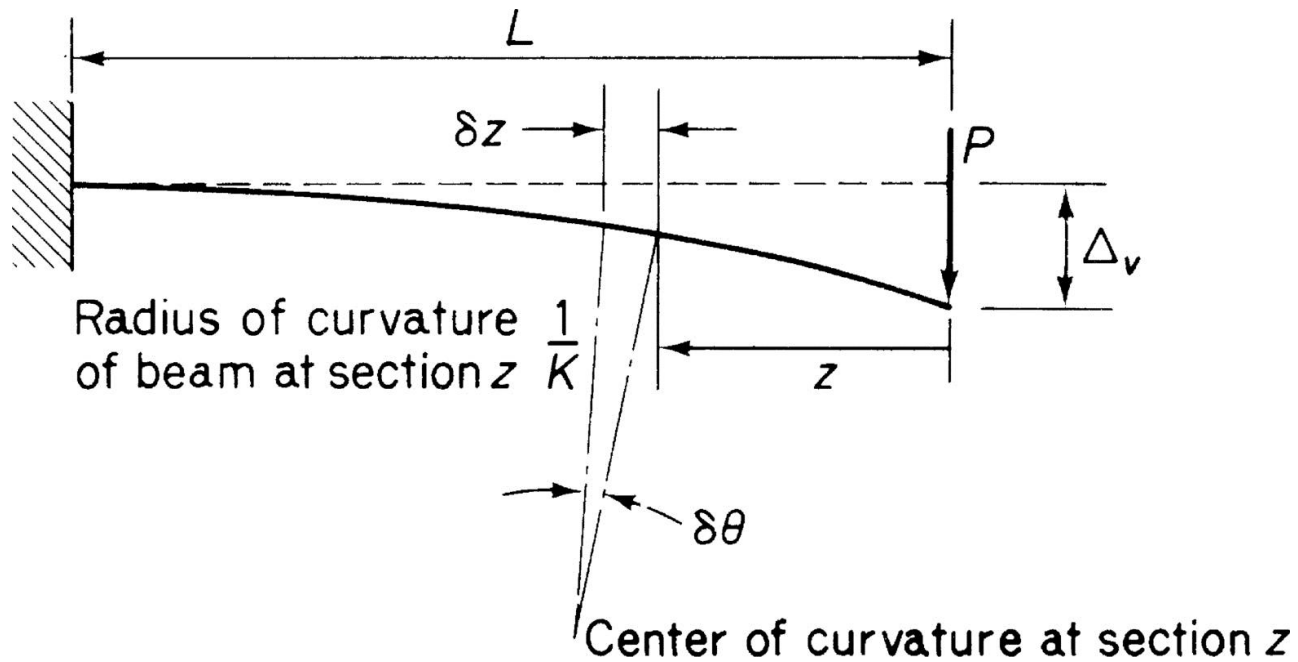


FIGURE 5.5 Beam Deflection by the Method of Complementary Energy

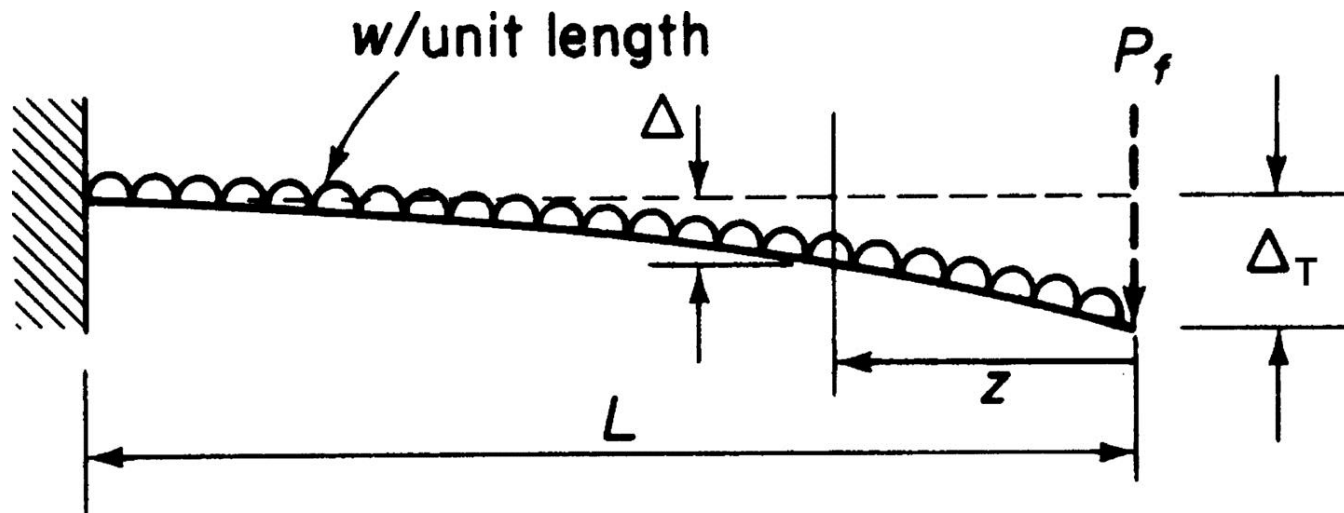


FIGURE 5.6 Deflection of a Uniformly Loaded Cantilever by the Method of Complementary Energy

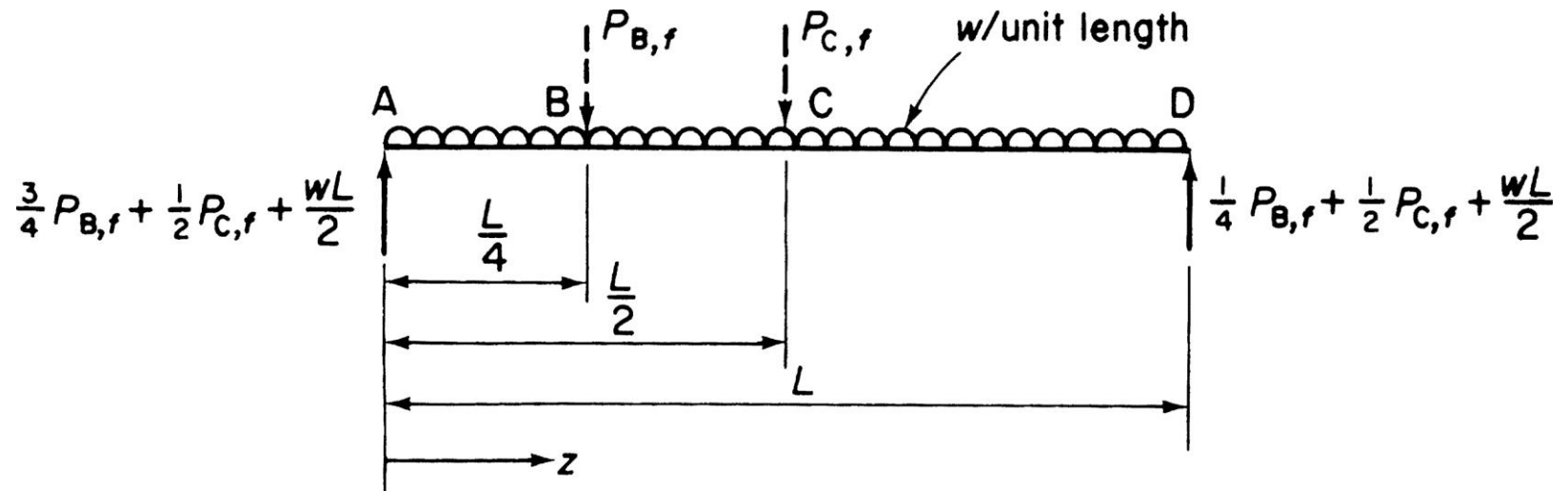


FIGURE 5.7 Deflection of a Simply Supported Beam by the Method of Complementary Energy

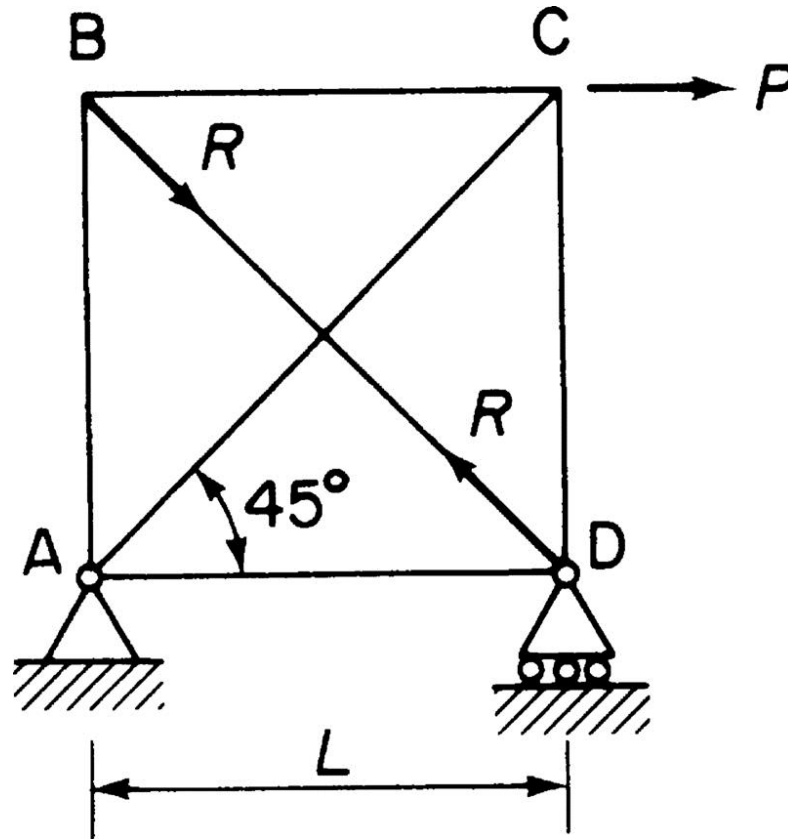


FIGURE 5.8 Analysis of a Statically Indeterminate Framework by the Method of Complementary Energy

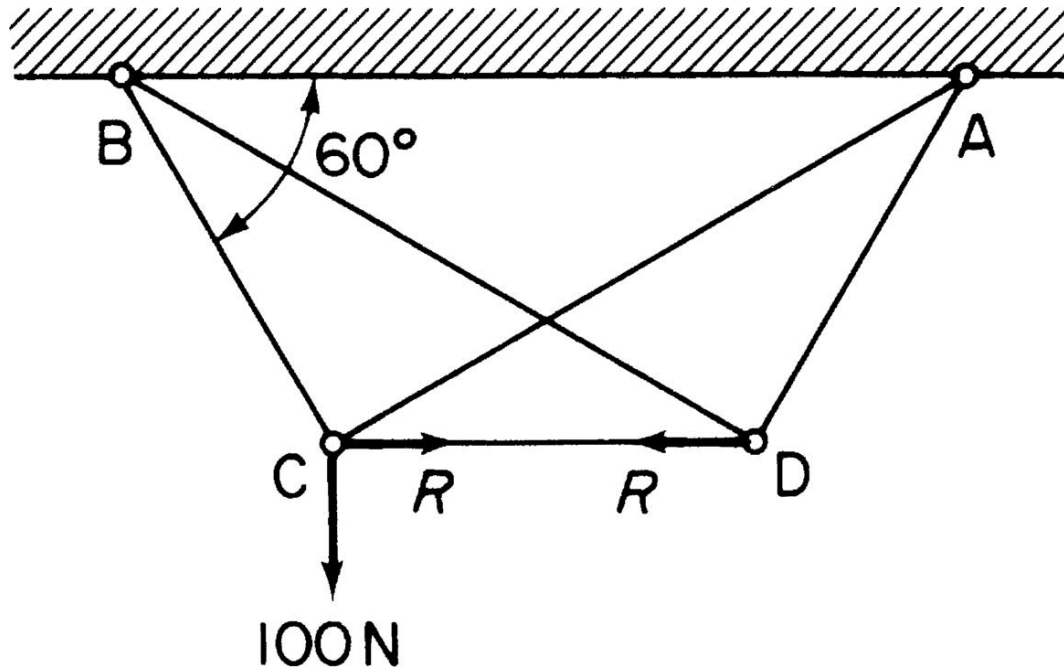


FIGURE 5.9 Framework of Example 5.8

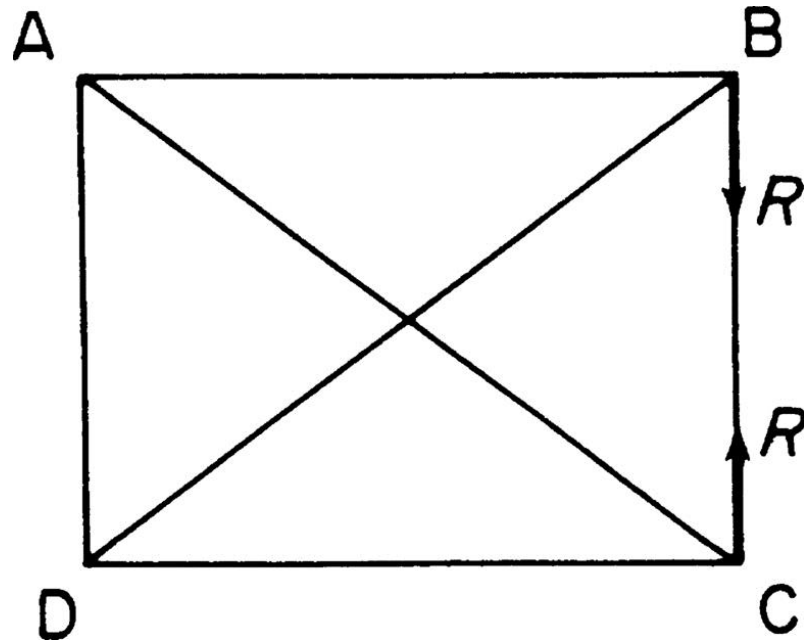


FIGURE 5.10 Framework of Example 5.9

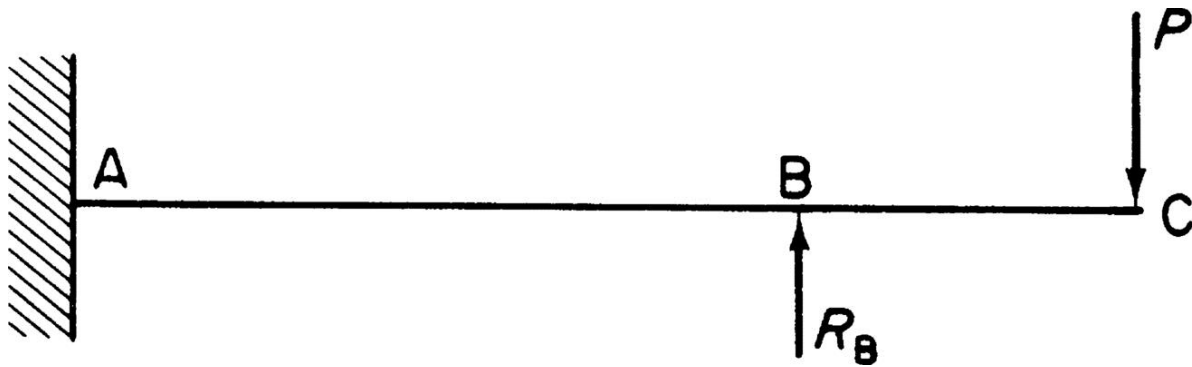


FIGURE 5.11 Analysis of a Propped Cantilever by the Method of Complementary Energy

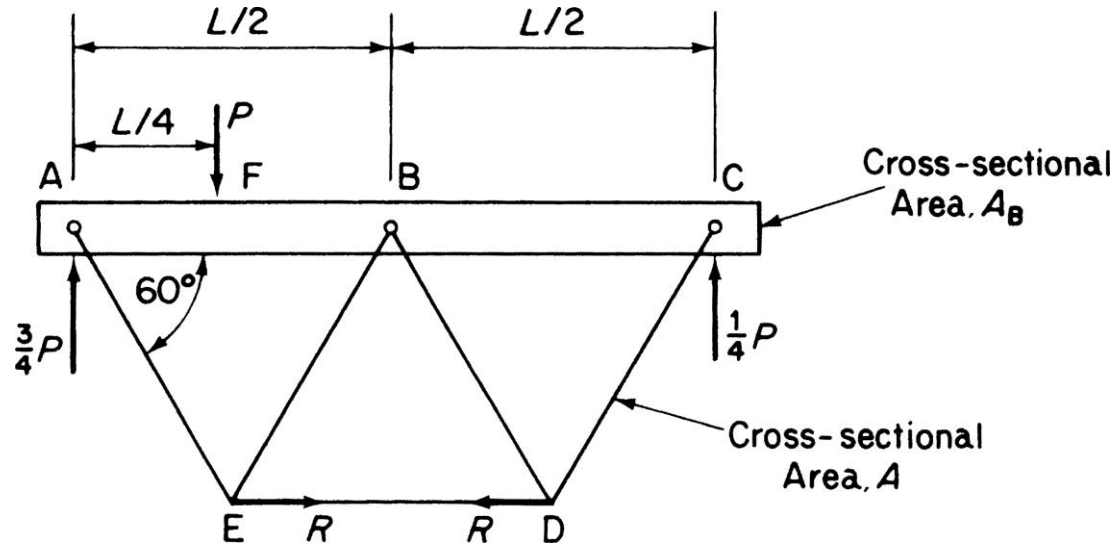


FIGURE 5.12 Analysis of a Trussed Beam by the Method of Complementary Energy

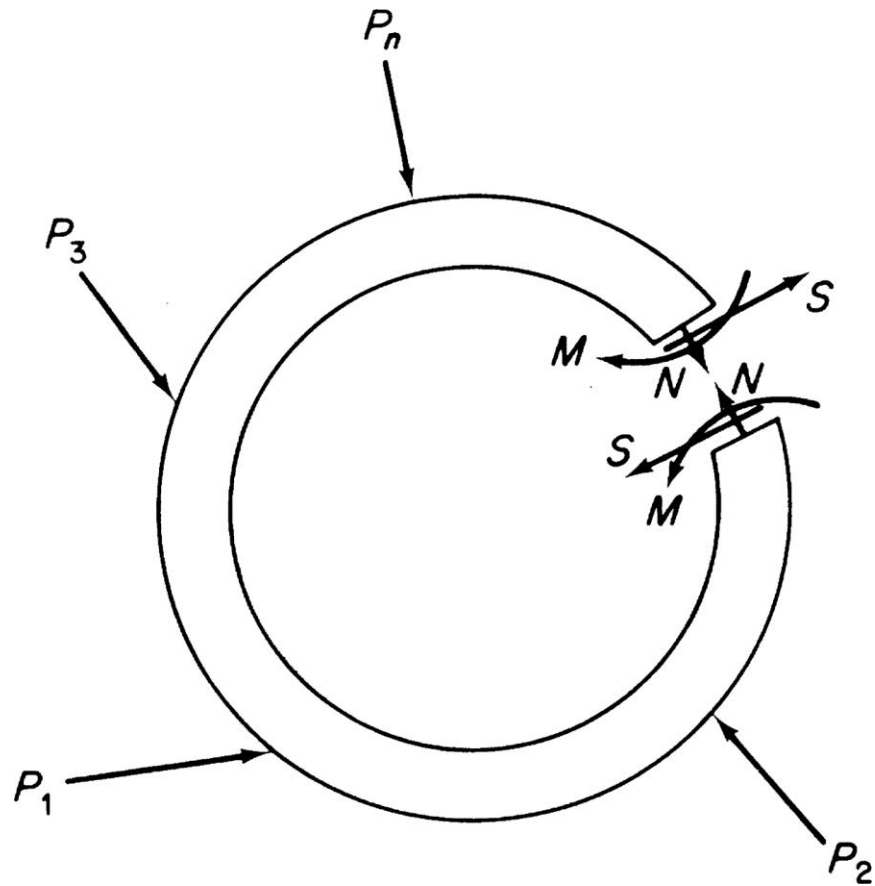


FIGURE 5.13 Internal Force System in a Two-Dimensional Ring

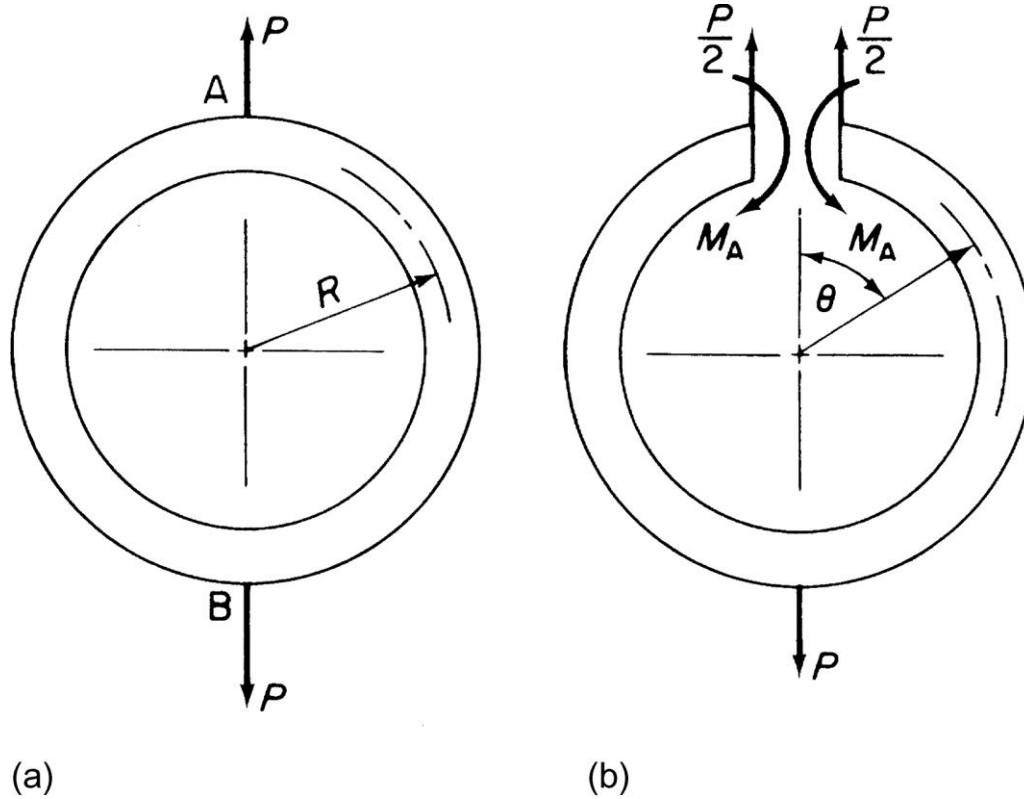


FIGURE 5.14 Doubly Symmetric Ring

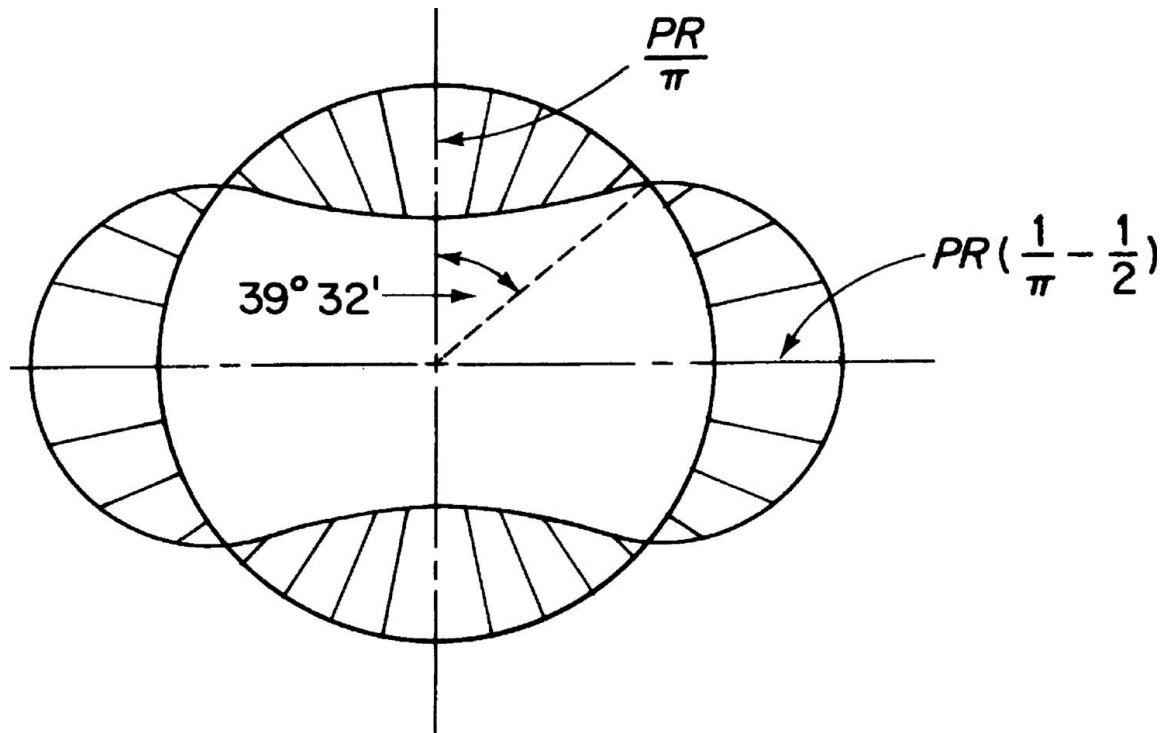


FIGURE 5.15 Distribution of Bending Moment in a Doubly Symmetric Ring

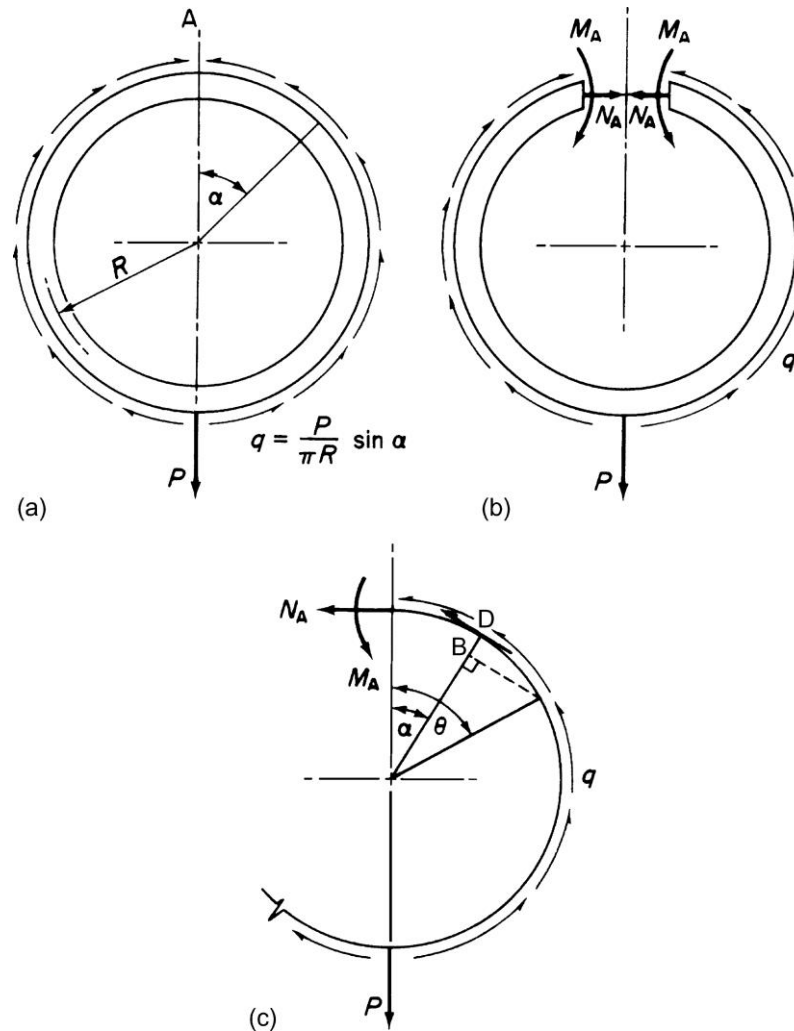


FIGURE 5.16 Determination of Bending Moment Distribution in a Shear and Direct Loaded Ring

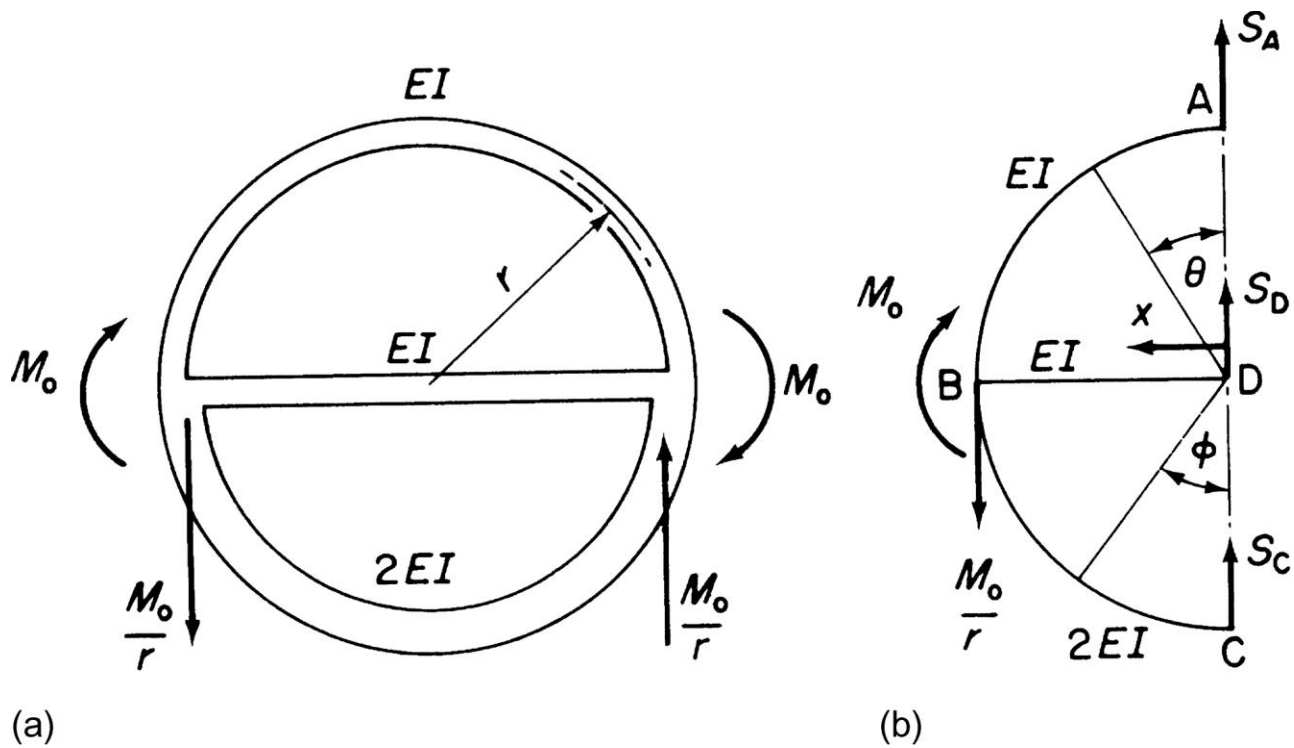


FIGURE 5.17 Determination of Bending Moment Distribution in an Antisymmetrical Fuselage Frame

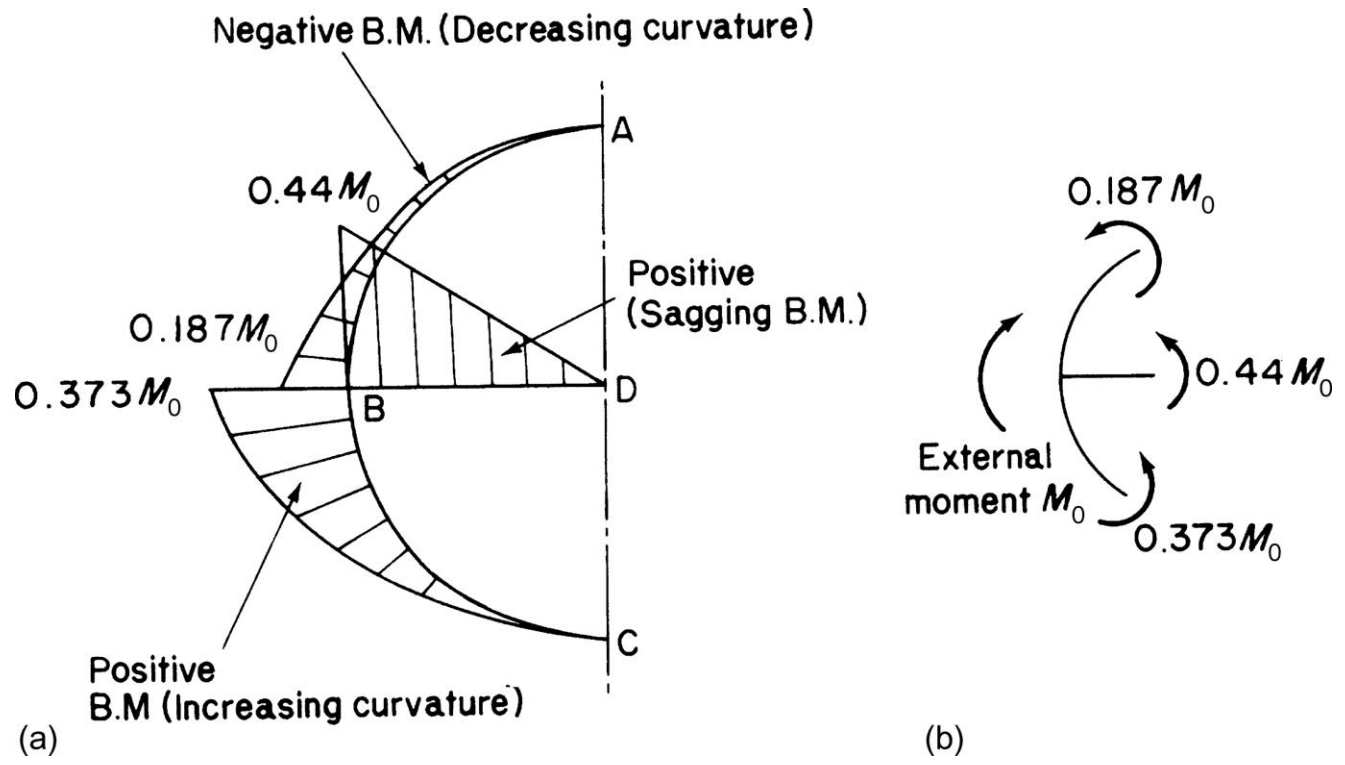


FIGURE 5.18 Distribution of Bending Moment in the Frame of Example 5.13

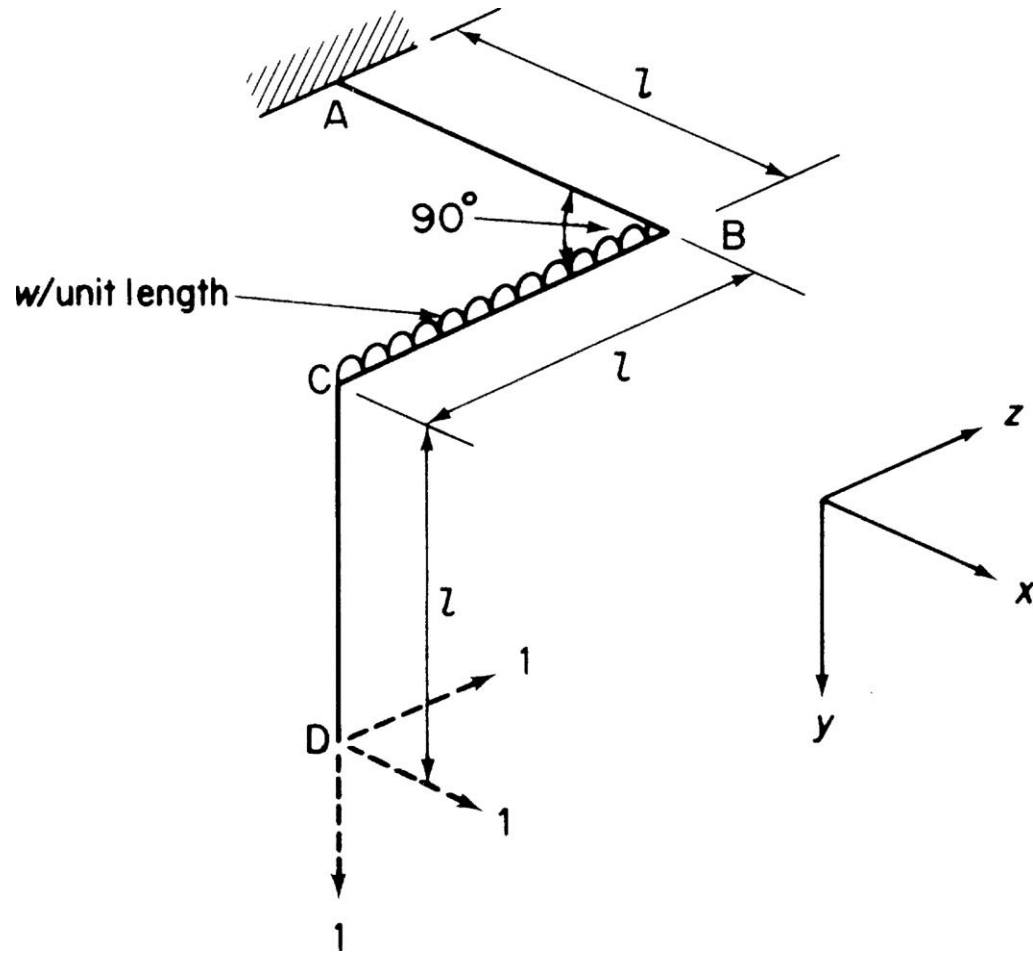


FIGURE 5.19 Deflection of a Bent Rod

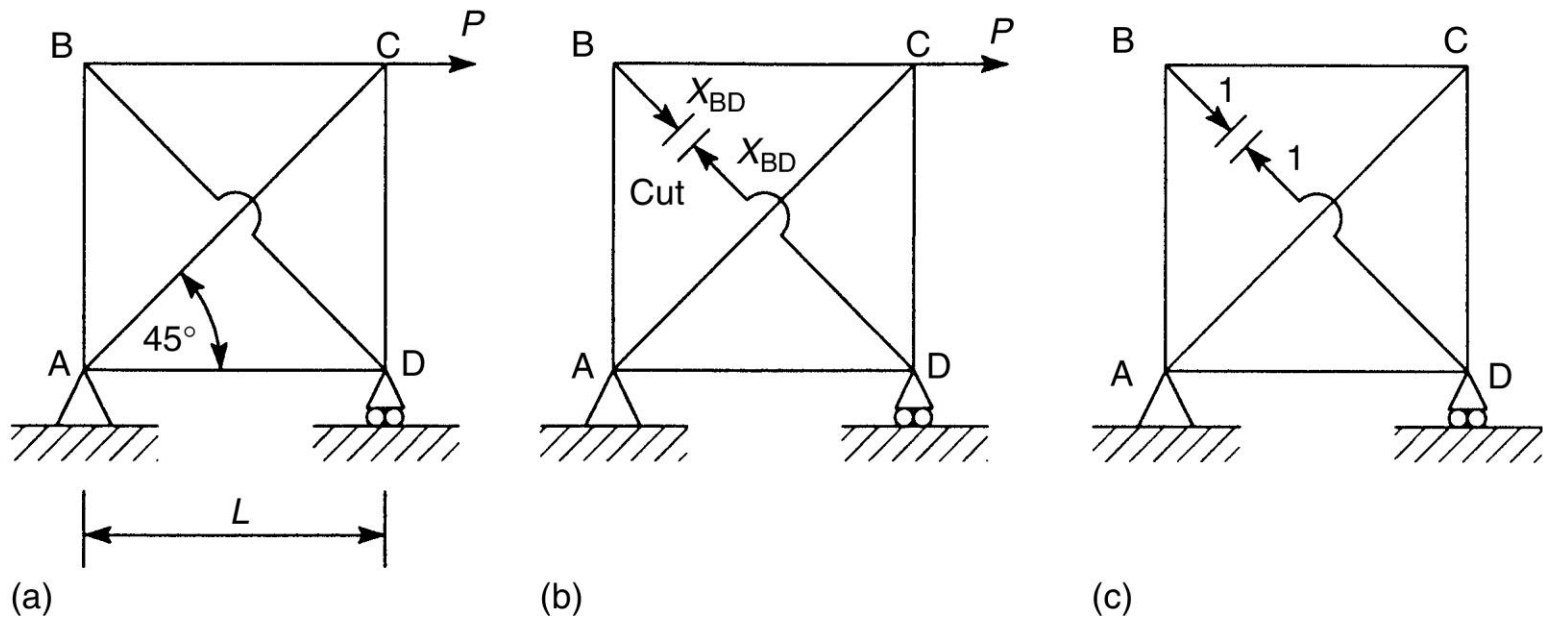


FIGURE 5.20 Analysis of a Statically Indeterminate Truss

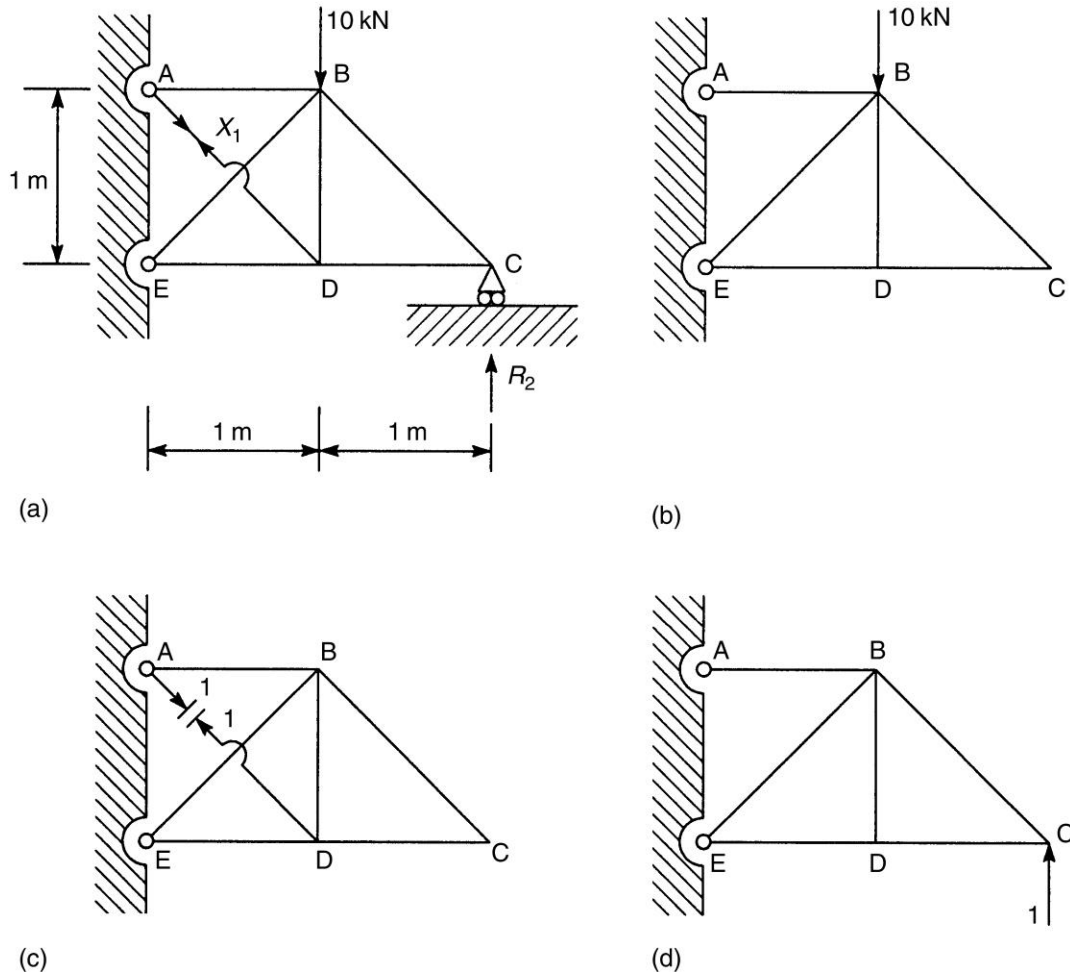


FIGURE 5.21 Statically Indeterminate Truss of Example 5.16

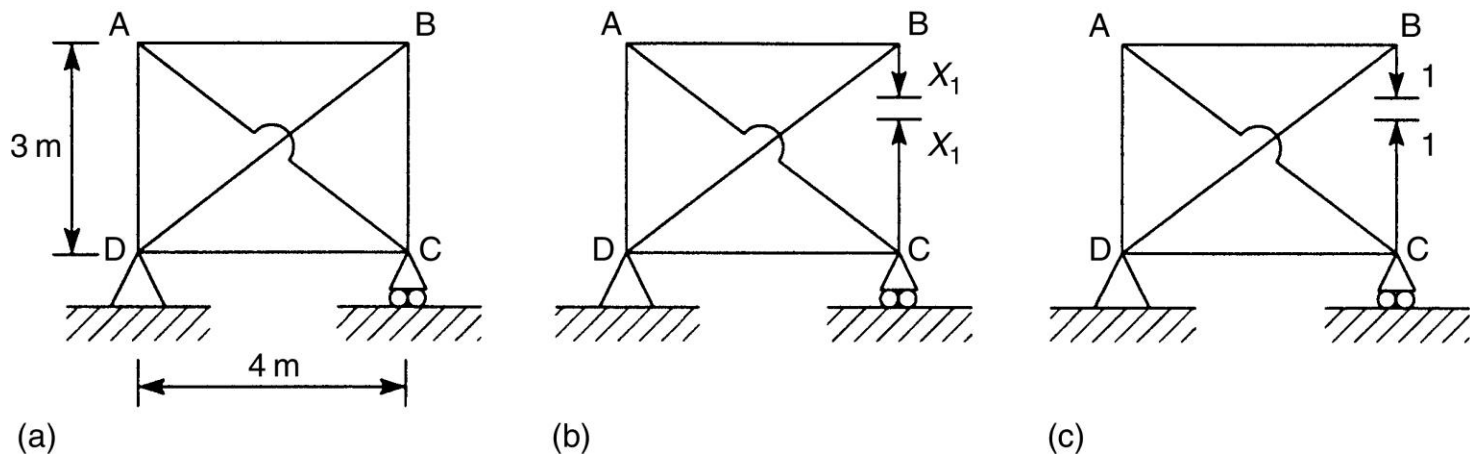


FIGURE 5.22 Self-Straining Due to a Temperature Change

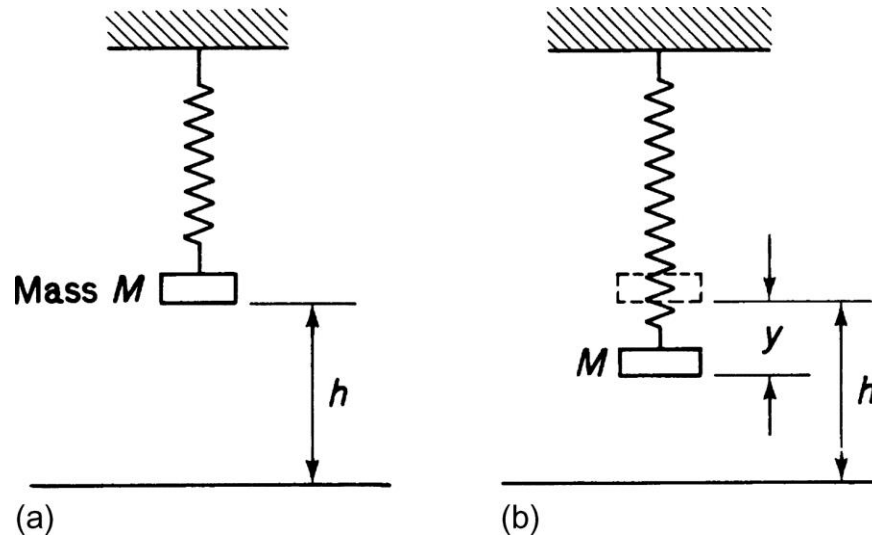


FIGURE 5.23 (a) Potential Energy of a Spring–Mass System; (b) Loss in Potential Energy Due to a Change in Position

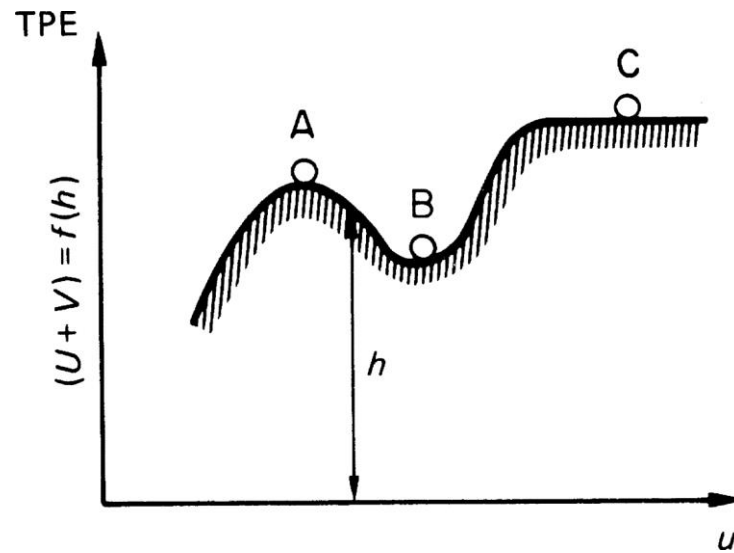


FIGURE 5.24 States of Equilibrium of a Particle

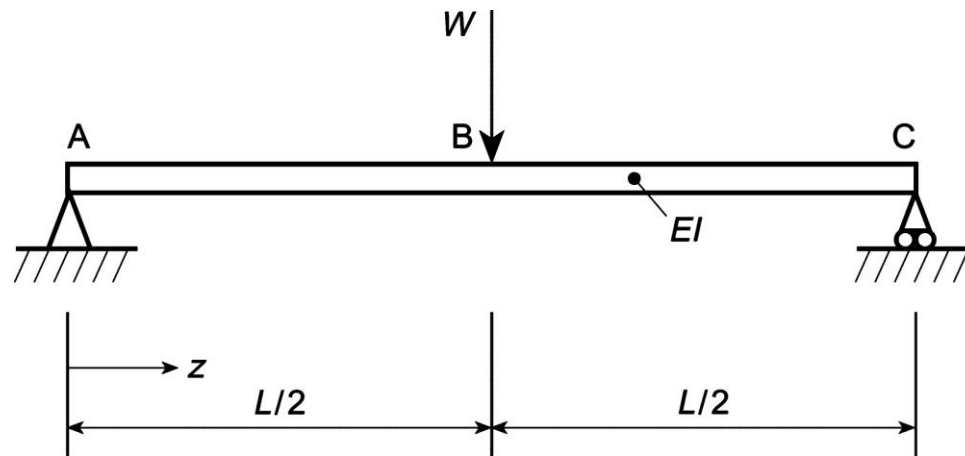


FIGURE 5.25 Approximate Determination of Beam Deflection Using Total Potential Energy

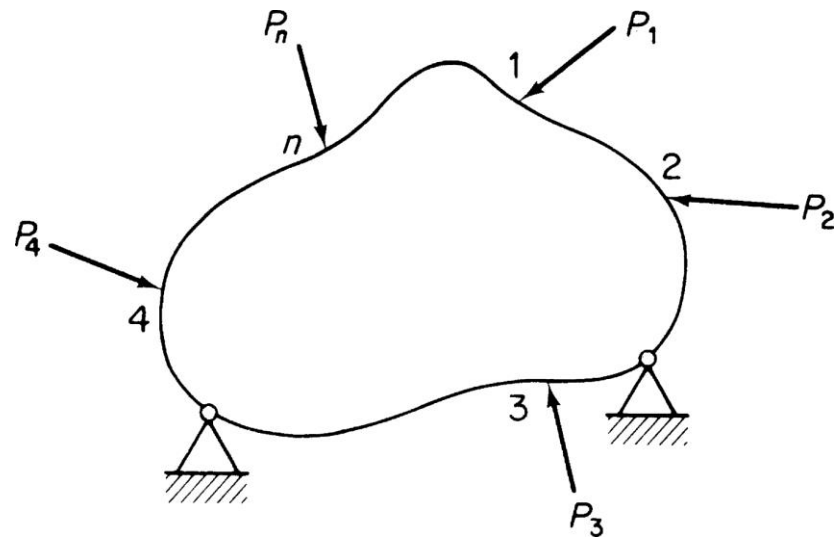


FIGURE 5.26 Linearly Elastic Body Subjected to Loads $P_1, P_2, P_3, \dots, P_n$

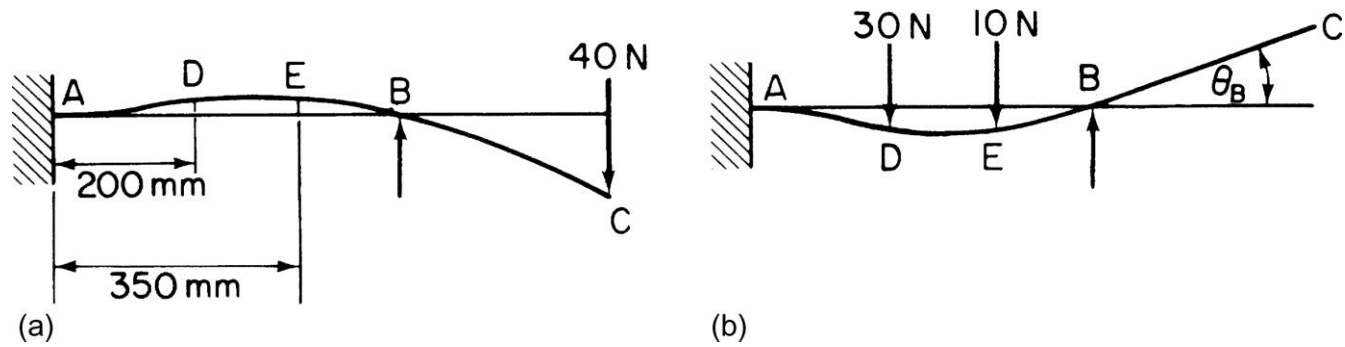


FIGURE 5.27 (a) Given Deflected Shape of Propped Cantilever; (b) Determination of the Deflection of C

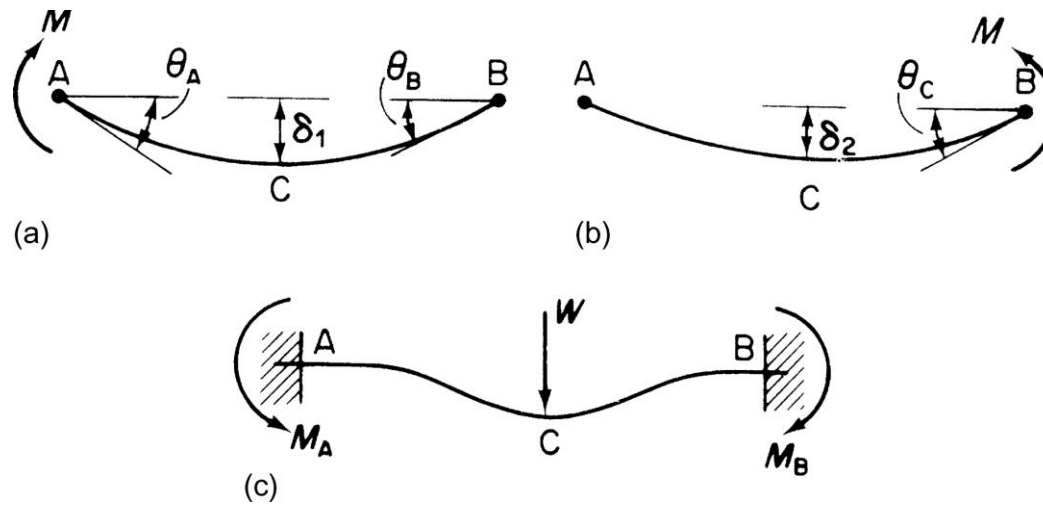


FIGURE 5.28 Model Analysis of a Fixed Beam

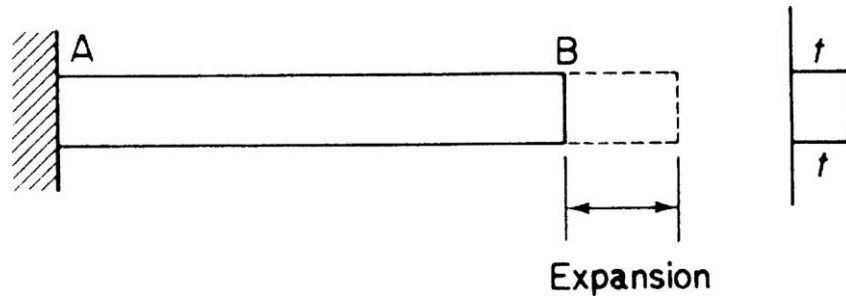


FIGURE 5.29 Expansion of Beam Due to Uniform Temperature

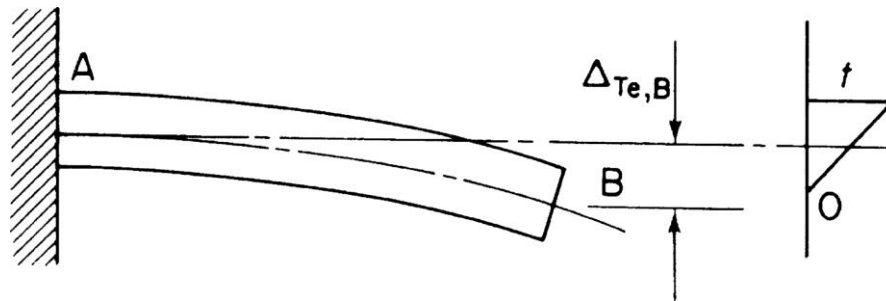


FIGURE 5.30 Bending of Beam Due to Linear Temperature Gradient

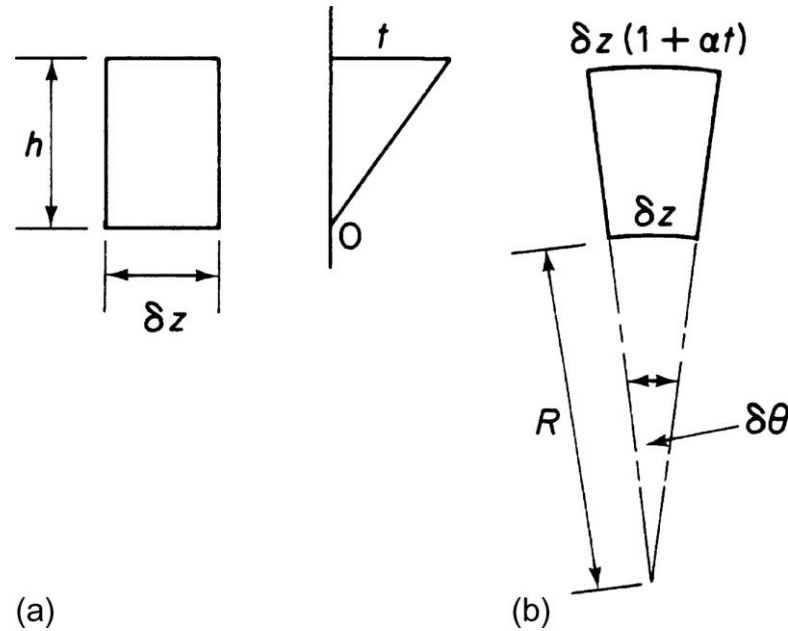


FIGURE 5.31 (a) Linear Temperature Gradient Applied to Beam Element; (b) Bending of Beam Element Due to Temperature Gradient

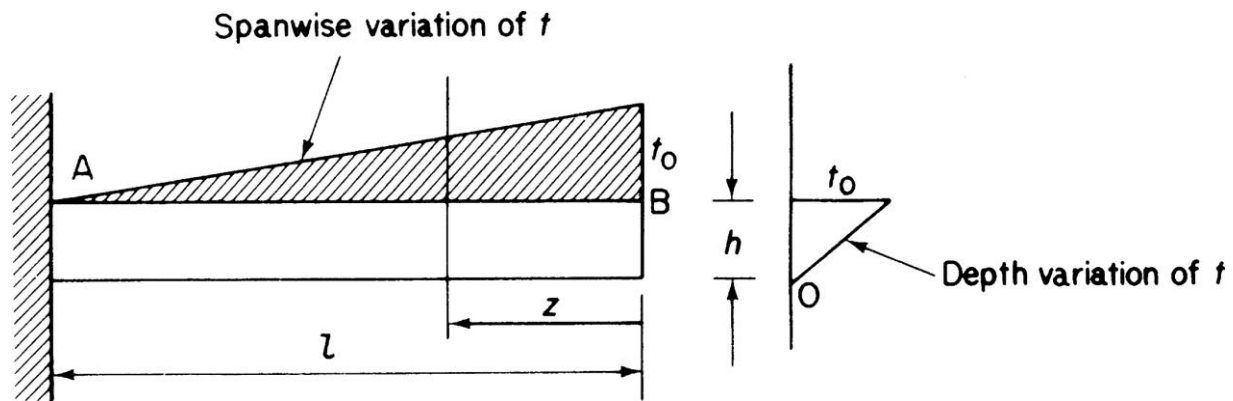


FIGURE 5.32 Beam of Example 5.21

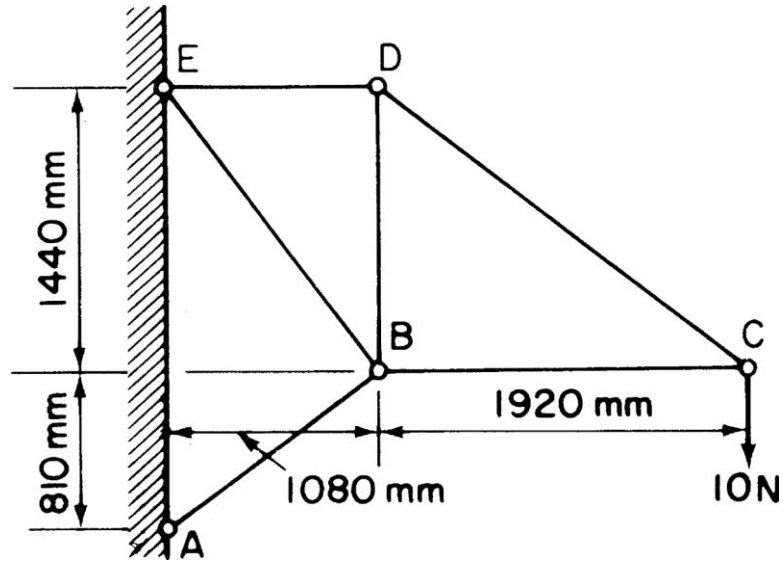


FIGURE P.5.1

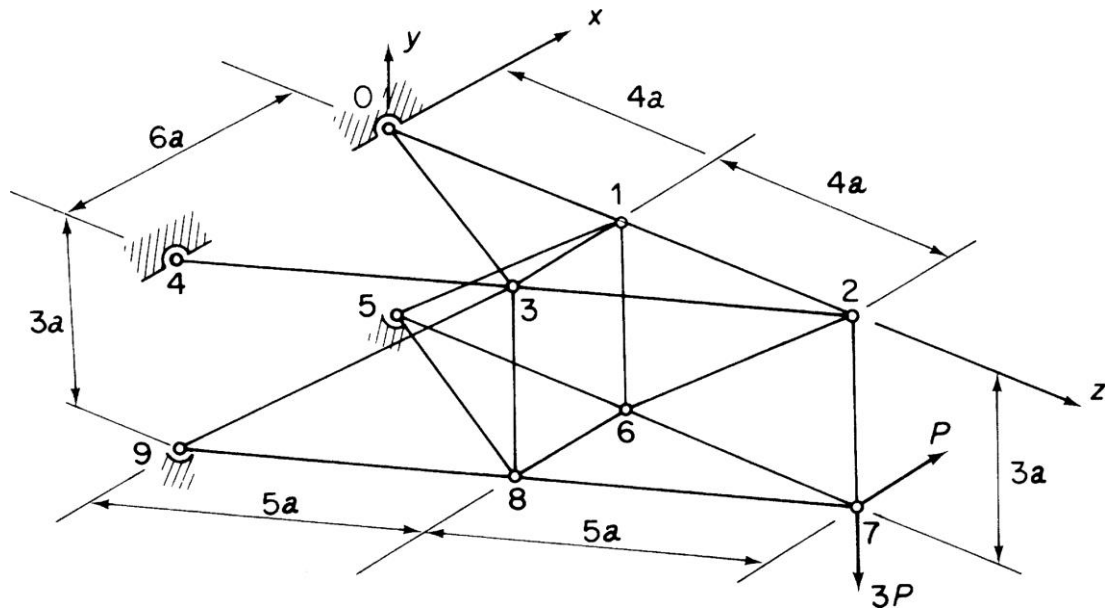


FIGURE P.5.3

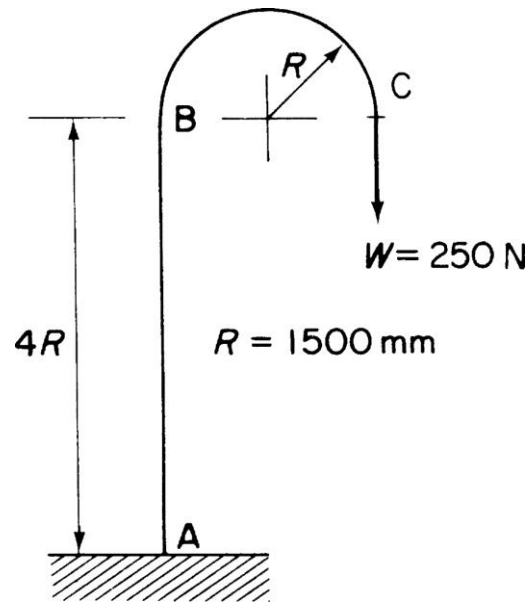


FIGURE P.5.5

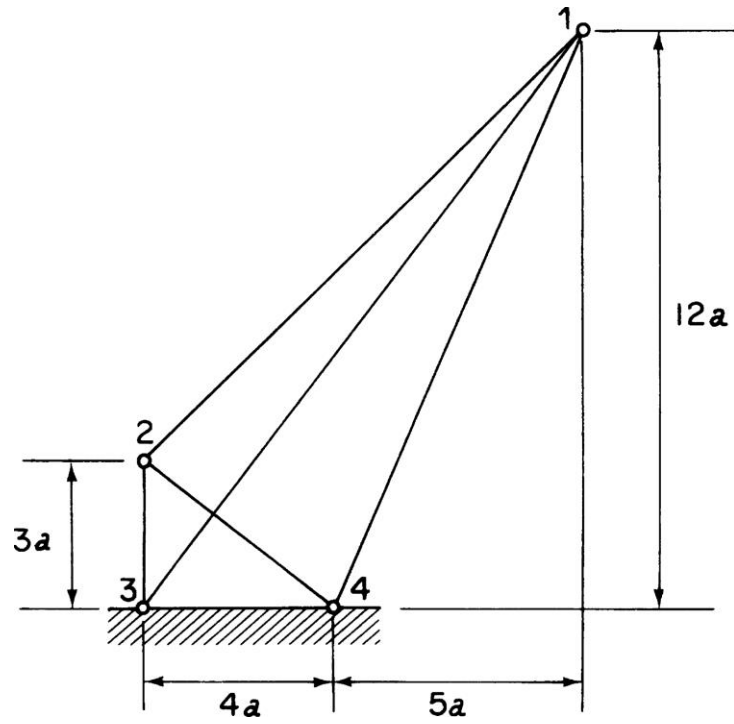


FIGURE P.5.8

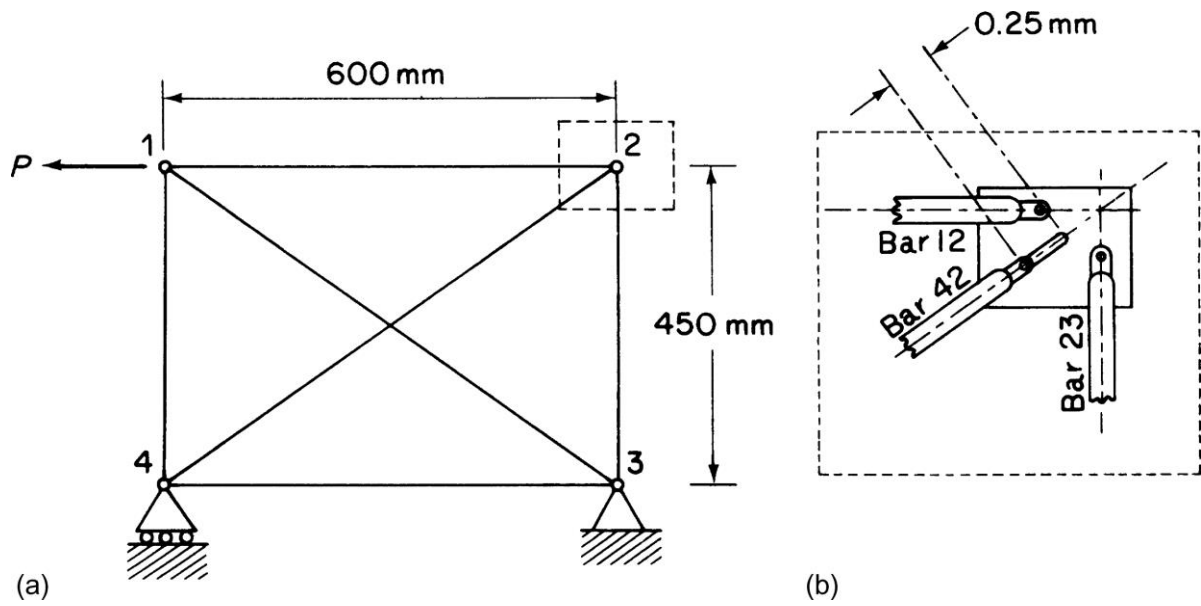


FIGURE P.5.9

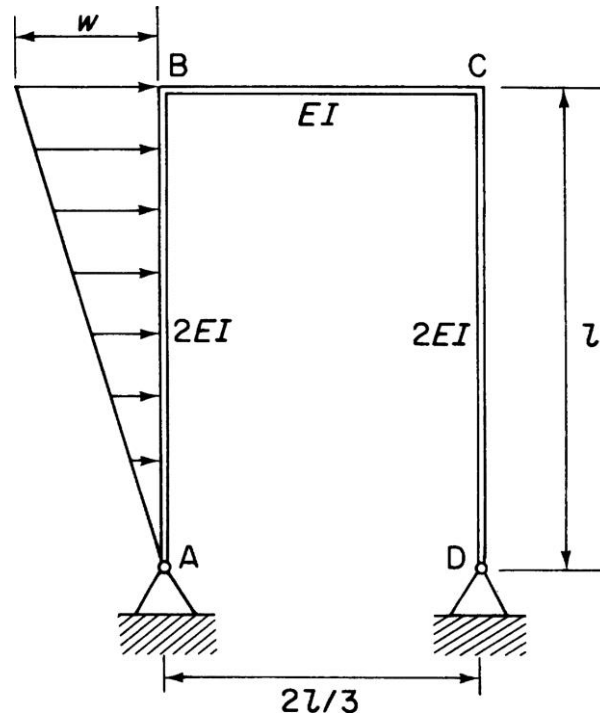


FIGURE P.5.10

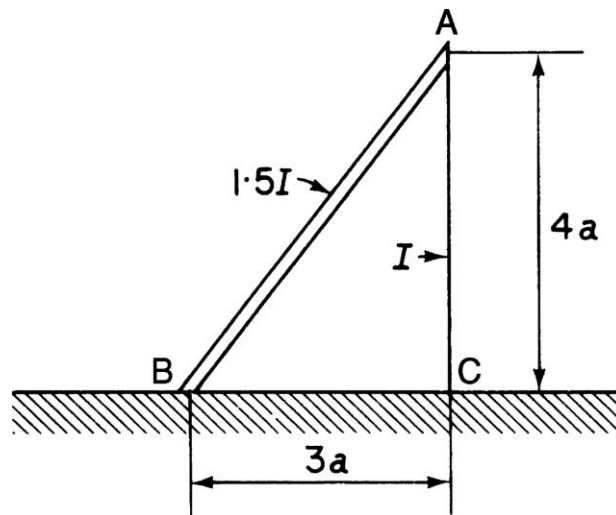


FIGURE P.5.11

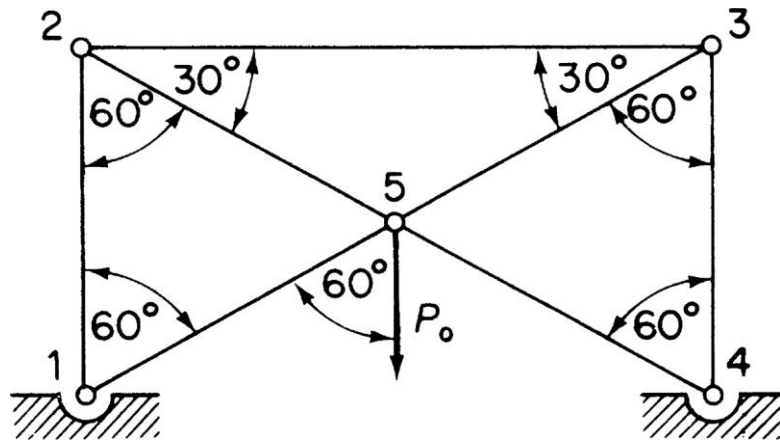


FIGURE P.5.12

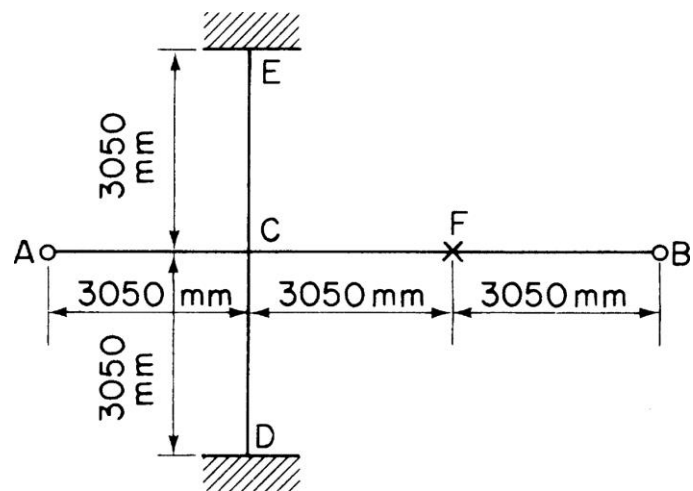


FIGURE P.5.13

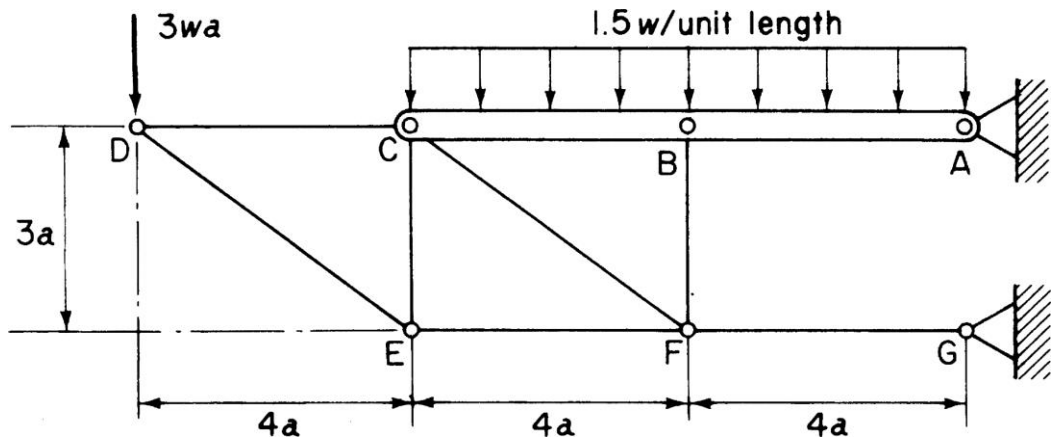


FIGURE P.5.14

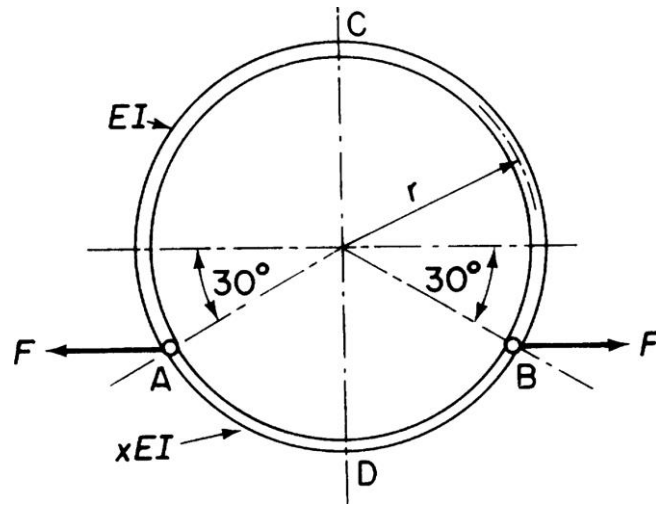


FIGURE P.5.15

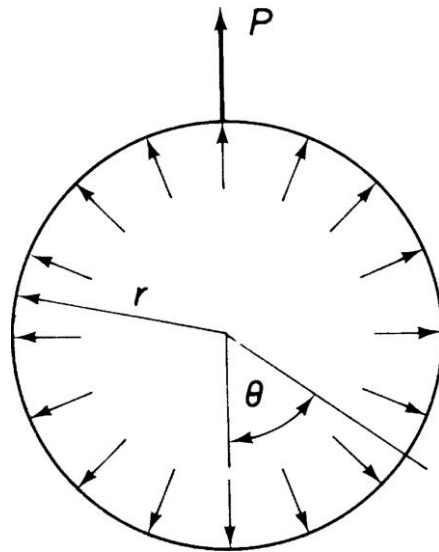


FIGURE P.5.16

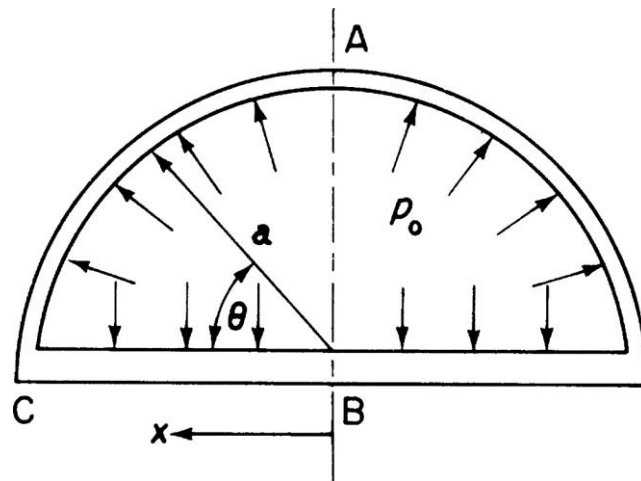


FIGURE P.5.17

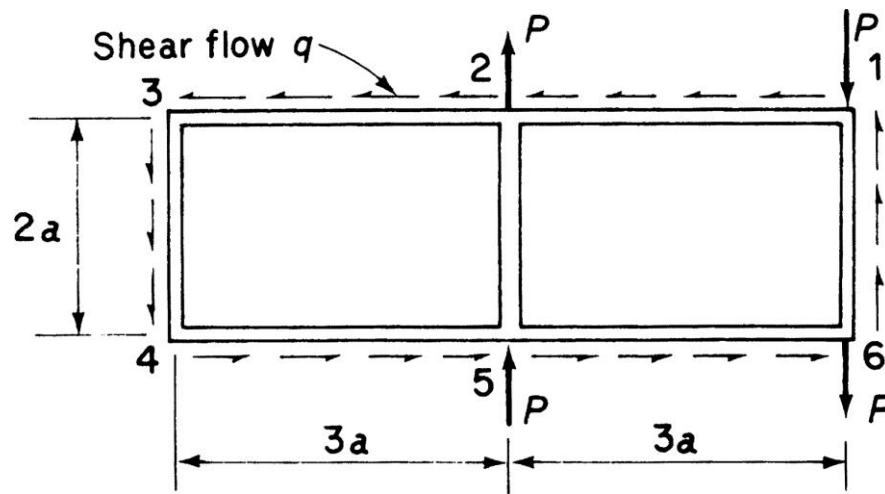


FIGURE P.5.18

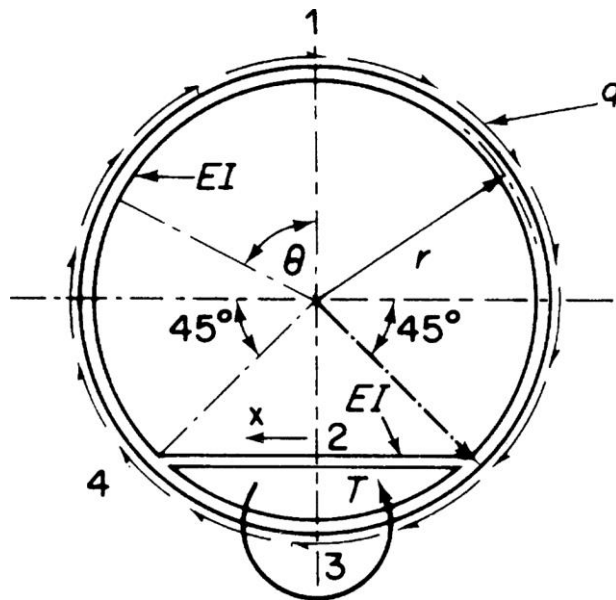


FIGURE P.5.19

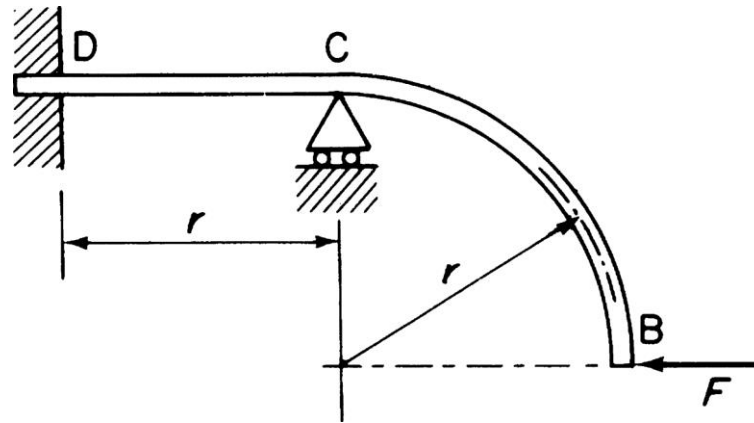


FIGURE P.5.20

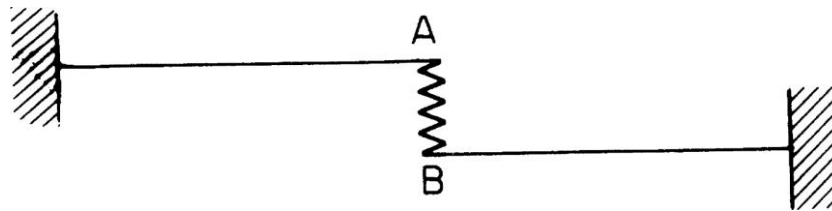


FIGURE P.5.21

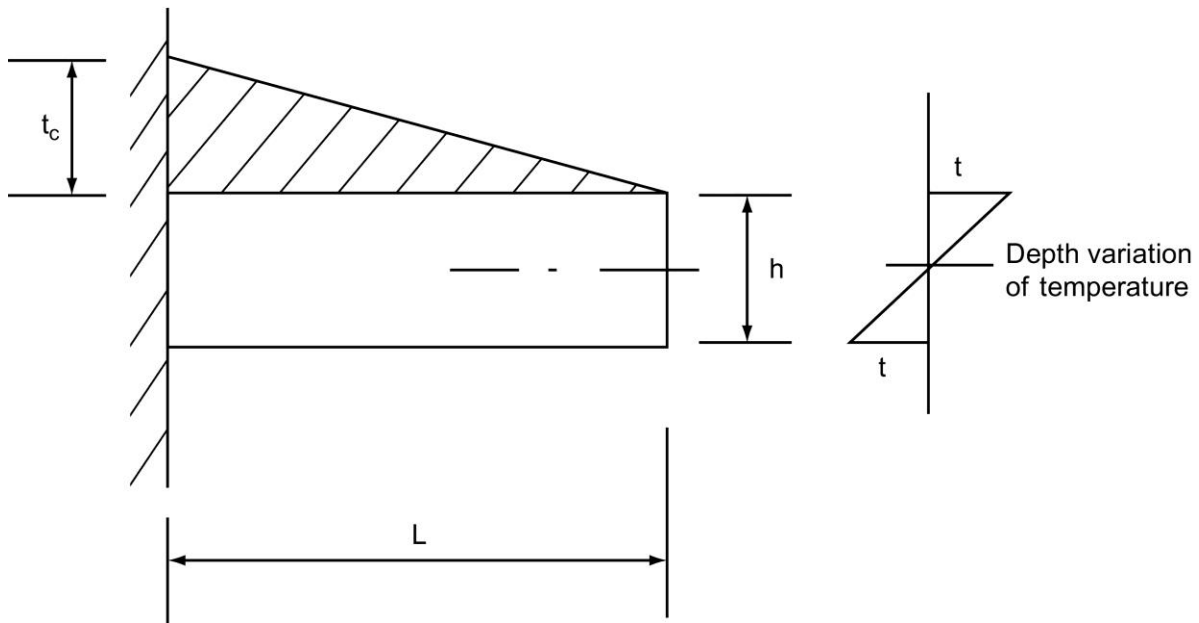


FIGURE P.5.23

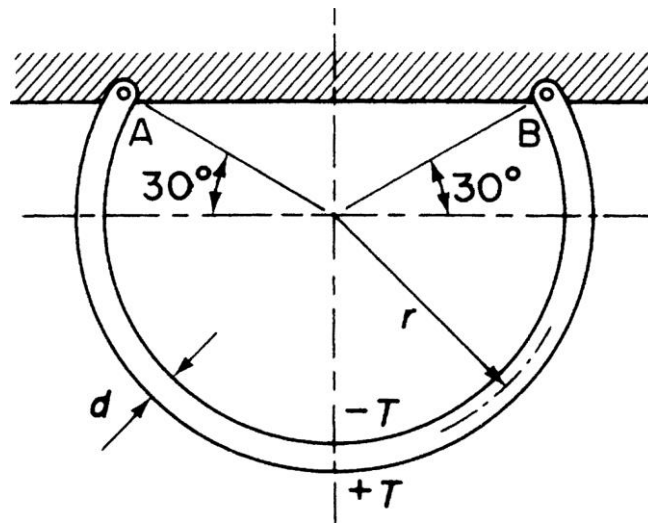


FIGURE P.5.24

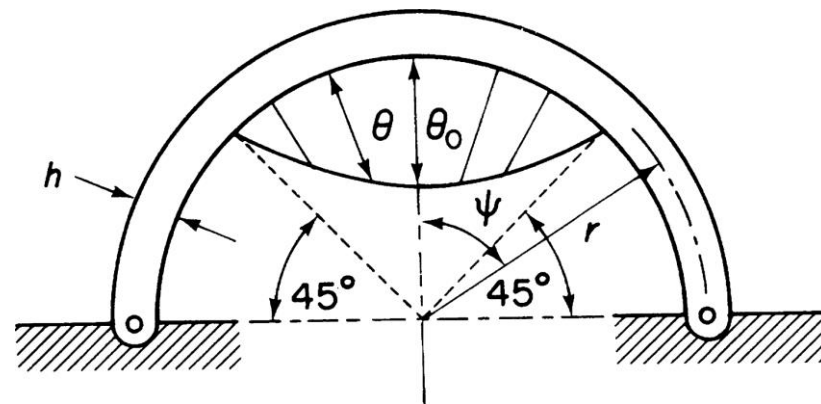


FIGURE P.5.25