Module 2 : Analysis of Statically Determinate Structures

Lecture 8 : Internal Force Diagrams for Various Systems

Objectives

In this course you will learn the following

- The different types of internal force diagrams that are needed for different types of structural member.

2.8 Internal Force Diagrams for Various Systems

We have discussed the general procedure for obtaining internal force variations in a planer system. We can apply that procedure for various types of structural system. Here, we discuss the significance of internal forces (and internal force diagrams) for different structural system types.

Truss : A truss members carries only axial force (tension or compression) and no shear force or bending moment. The axial force comes from loads applied only at the two ends of a member. Therefore, the axial force remains constant along the length of a single truss member. So, we do not really need to plot diagrams or express axial force as function of length (x) in case of a truss member.

Cable : A cable is similar to a truss member except for that it carries only axial tension. For further detail on internal forces in cables, see chapter 3.

Axially Loaded Bar : Only axial force exists in these members (such as columns). However, unlike a truss member a bar may be acted upon by external forces along its length. Hence, it is important to study the variation of axial force through diagrams/mathematical expressions.

Beam and Beam-Column : A beam carries shear force and bending moment and if it carries axial force as well, then we call it a beam-column. It is for these structural members that internal force diagrams are most important, because deformation and failure behaviour of these members can be directly linked to these diagrams.

Frame : Frames are two/three-dimensional structural systems made of beams and columns. A frame member, in general, carries internal forces similar to a beam-column. Therefore, it is equally important to obtain internal force diagrams for these systems. Note that for a frame, we may need to specify sign convention for each member individually, as these members may have different orientations.

Arch : Arches can be treated as curved beams (or beam-columns). We will discuss later (in Section 2.12) how to deal with a curved centroidal axis, and with orientations of axial and shear forces.

In the next few sections we will discuss specific cases of determining forces in different types of statically determinate systems, such as trusses, beams, arches, etc.

Recap

In this course you have learnt the following

- The different types of internal force diagrams that are needed for different types of structural member.