

## Module 2 : Analysis of Statically Determinate Structures

### Lecture 2 : Internal Forces Acting on Typical Structural Members

#### Objectives

In this course you will learn the following

- Internal forces in different types of structural members.
- Categorization of internal forces in 2D and 3D systems.

#### 2.2 Internal Forces Acting on Typical Structural Members

It is mentioned in Section 1.1 that one method of classifying structural systems is on the basis of their load transfer mechanisms. To elaborate, a system (or a structural member) is identified based on the predominant types of internal forces carried by it. Thus we have: *bars*, *cables*, *beams*, *columns*, *arches*, etc. Below is a list of such members along with the predominant internal forces that they carry. Cable : A cable or wire can carry axial tension only. Internal forces in cables are not discussed in this chapter because cables are very different from all other systems due to their flexible geometry. Internal forces and geometry of cable systems are discussed in detail in chapter 3.

**1. Cable :** A cable or wire can carry axial tension only. Internal forces in cables are not discussed in this chapter because cables are very different from all other systems due to their flexible geometry. Internal forces and geometry of cable systems are discussed in detail in chapter 3.

**2.Bar :** A bar carries only axial forces – tension and compression both. That is why it is also known as *axially loaded bar*.

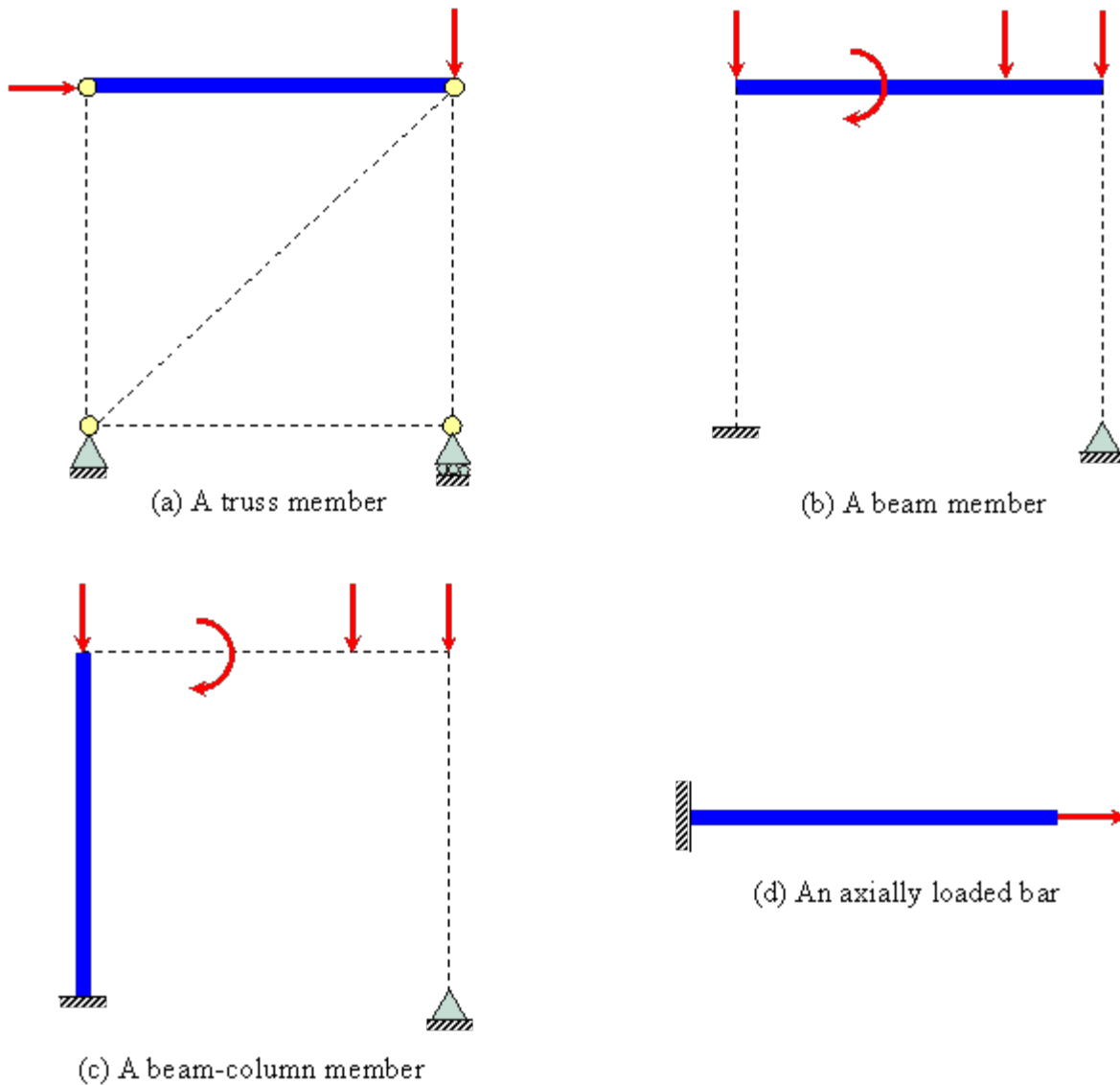
**3.Beam :** A beam's primary function is to transfer lateral loads applied externally on the beam. These loads produce bending moments and shear forces on beam a cross-section.

**4.Column :** The predominant internal force in a column is axial compression.

**5.Beam-Column :** A beam-column, as the name suggests, carries all kinds of internal forces that are produced in a beam or a column, which include: bending moment, shear force and axial force.

**6.Arch:** An arch is a curved member which carries primarily axial compression under lateral loads applied externally.

There is no difference in the shapes of a beam, a column, a beam-column or a bar. All are straight longitudinal members (one dimension is much larger than the other two) and we will not be able to distinguish one from the other unless we know the load transfer mechanism. Figure 2.2 illustrates this issue.



**Figure 2.2 Different member types having similar shapes**

All the members discussed above are primarily one-dimensional geometrically. Two-dimensional members are also categorized similarly, such as: *plates*, *shells* (*thin & thick*), *slabs*, etc. We also have specific names for systems formed by combination of members, such as a *truss* or a *frame*. A frame is a combination of beams and columns, whereas all the members in a truss are axially loaded bars.

**Recap**

In this course you have learnt the following

- Internal forces in different types of structural members.
- Categorization of internal forces in 2D and 3D systems.