Transcript for 5.3 Trusses

0:01

Hello. In today's video lecture, we are going to talk about trusses. A truss is a type of engineering structure in which all members are two-force members. Here is an example of something we would describe as a truss. In this truss bridge, all of the beams are connected at their endpoints, and forces act at those endpoints. Therefore, all members are two-force members. All two-force members are either in tension or compression. The forces acting on them are equal and opposite, and they act along the line of action between the two endpoints of the beam.

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Trusses can be further broken down into plane trusses and space trusses. A plane truss exists entirely in one plane, essentially making it a 2D truss. Here are some plane trusses used for roofs; there is a whole stack of them, and they function as 2D trusses. We analyze these trusses as 2D systems. Sometimes, we can approximate parts of a 3D structure as a plane truss. For example, in this bridge, we have two plane trusses on the sides and horizontal members called stringers that connect the two sides but do not carry much load. We would approximate this as a plane truss by looking at the side view of the bridge and identifying where the forces act.

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Alternatively, we have a space truss. A space truss does not lie in a single plane; it occupies space. Here is an example of a space truss used to support a roof. It consists of a complex series of repeating pyramid-like shapes. Another example is this tower, which is also a truss but cannot be broken down into a 2D shape. This means we analyze these trusses as fully 3D systems.

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When analyzing any structure, we aim to determine the forces acting on each individual member. If each member is a two-force member, we need to find the magnitude of the force—how strong it is in either tension or compression—and determine whether the member is in tension or compression. Members react differently depending on the type of force. Something might fail in compression before it fails in tension. Therefore, we must identify all forces in all members.

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There are two main methods for analyzing trusses. The first is the method of joints, which focuses on the connection points where members meet. This is generally the fastest way to solve for all unknown forces when analyzing an entire truss.

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The second method is the method of sections. This involves theoretically cutting the truss into multiple sections and analyzing each section as a rigid body. If we want to find the force in a specific member, the method of sections allows us to jump directly to that member and determine its force quickly.

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We can also use a hybrid of the two methods. If we need to find the forces in several specific members, we might start with the method of sections and then use the method of joints to work outward from there. These are the methods available for analyzing trusses.

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That concludes today’s video lecture. Thank you for watching, and I hope to see you again.