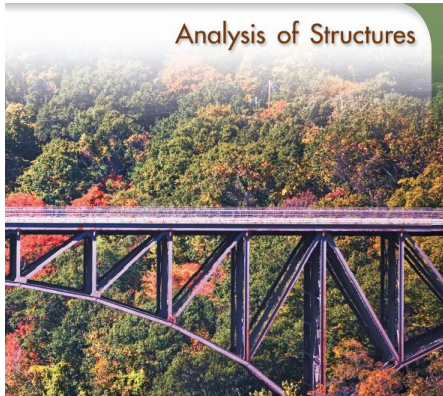


Static and Strength of Materials

Chapter 4-Structures-Part I

Mehdi Tale Masouleh



November 8, 2013



Structures

Introductions

- In this chapter we focus on the determination of the forces internal to a structures.
- That is, forces of action and reaction between the connected members.
- Thus, the third law of Newton would be of great help!
- A definition by Meriam: An engineering structure is any connected system of members built to support or transfer forces and to safely withstand the loads applied to it.

There are four categories of engineering structures:

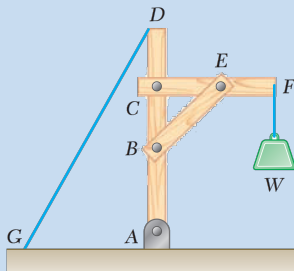
- 1 Trusses
- 2 Frames
- 3 Machines
- 4 Beams



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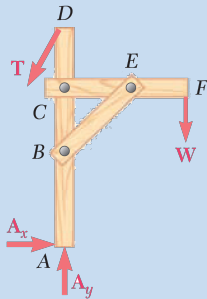




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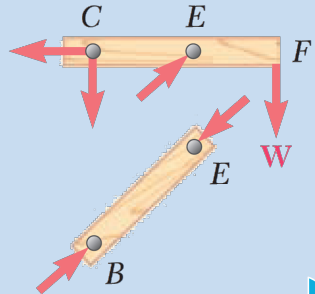




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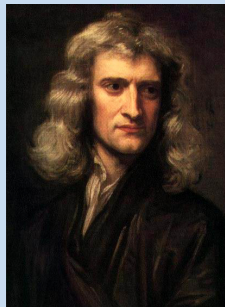




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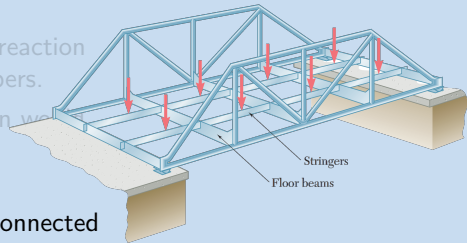




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Structures

Engineering Structures

- Truss: are designed to support loads and are usually stationary, fully constrained structures.
- Trusses consist exclusively of straight members connected at joints located at the ends of each member.
- Members of a truss, therefore, are two forces members, i.e., members acted upon by two equal and opposite forces directed along the member

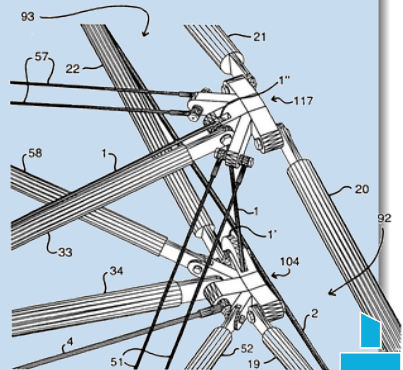




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I dedicate this photo to the Er
Power of the class



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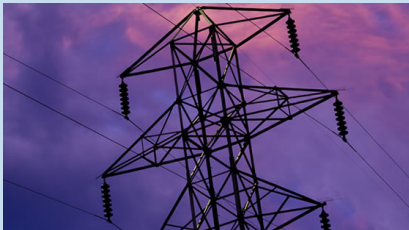
This is your day so enjoy! One more!



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Hey! Power Eng. You depend on Mechanical Eng. ;)



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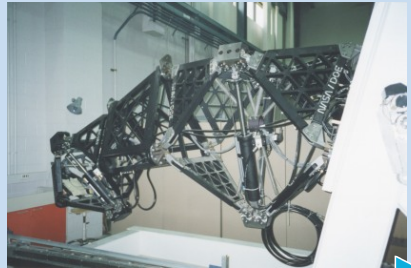




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Truss in robotic contexts



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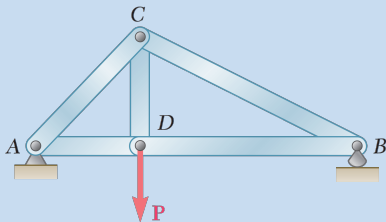


Plane Trusses

Simple Trusses

- A plane truss
- A **simple truss** is a planar truss which begins with a triangular element and can be expanded by adding two members and a joint. For these trusses, the number of members (m) and the number of joints (j) are related by the equation:

$$m = 2j - 3$$



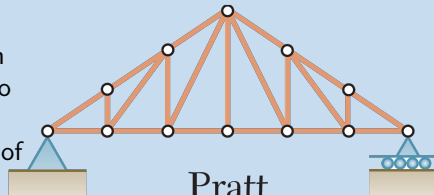


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A simple truss

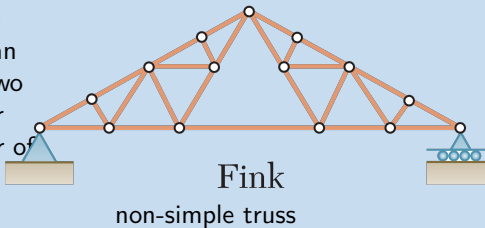


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non-simple truss

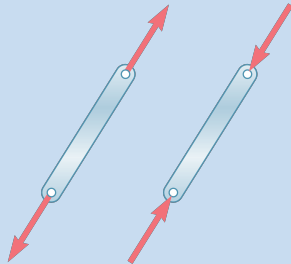


Plane Trusses

Analysis and design assumptions

- The force analysis of a truss is based on the following assumptions:
 - 1 All load are applied at the joints
 - 2 The weight of the truss member is often neglected as the weight is usually small a compared to the forces supported bu smooth pins.
 - 3 The above is satisfied in most practical cases where the joint are formed by bolting or welding

These leads to have:



Thus, the members act as two-force members. They are loaded in either tension or compression. Often compressive members are made thicker to prevent **buckling**.