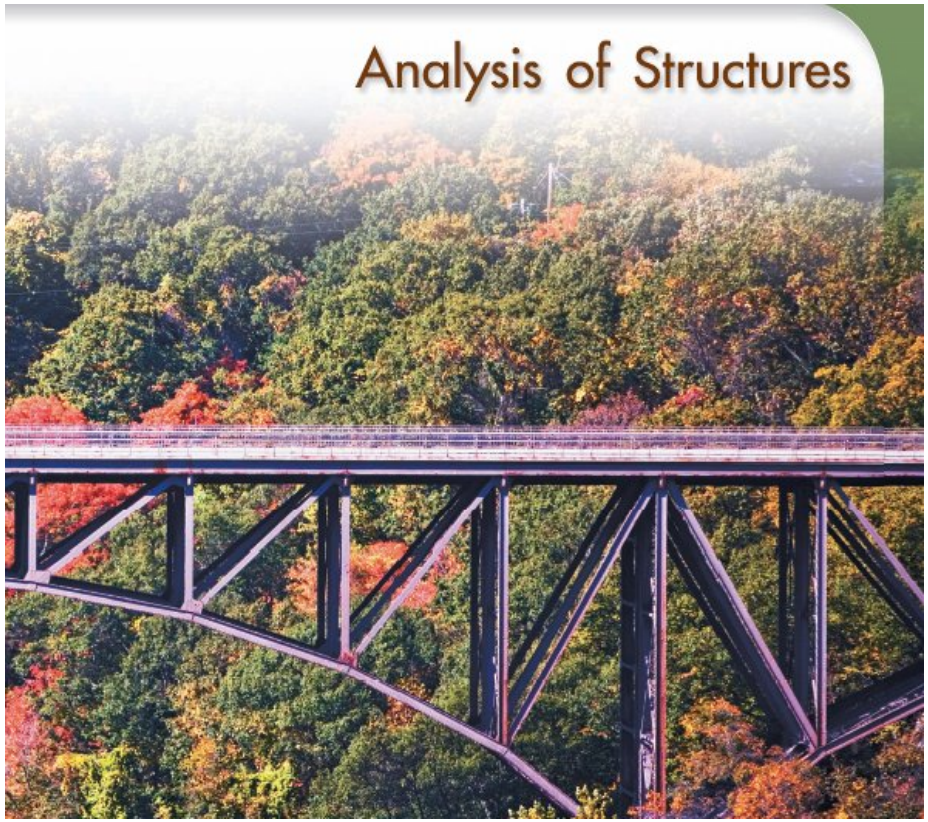
Static and Strength of Materials
Chapter 4-Structures-Part II

Mehdi Tale Masouleh



November 8, 2013

Plane Trusses

Truss connections and supports

- For connection:
  1. Welded
  2. Riveted
  3. we assume all as pin joints
  4. Pass through the same point
- For large trusses at one of the supports:
  1. A roller
  2. A rocker
  3. Some kind of slip joint
  4. Why!? (This could be your exam question)

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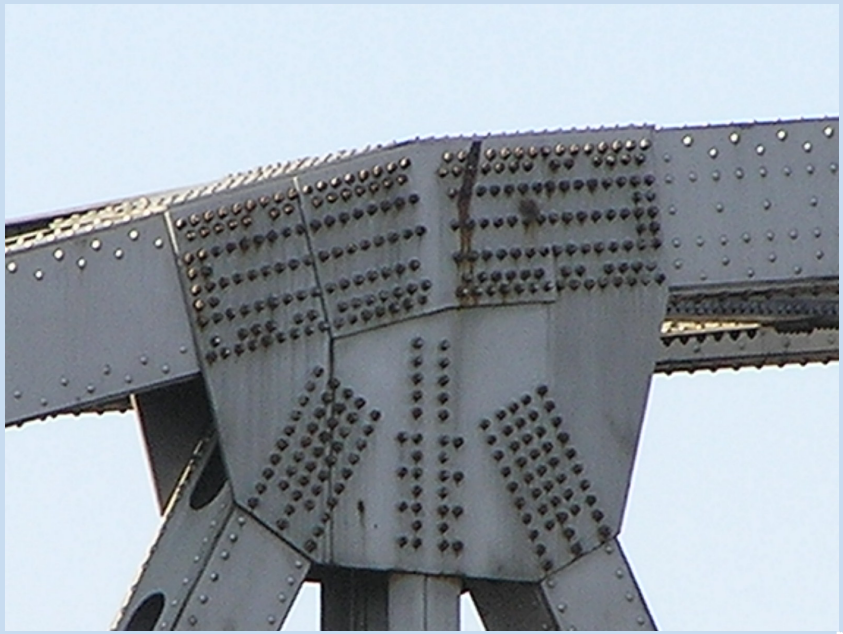

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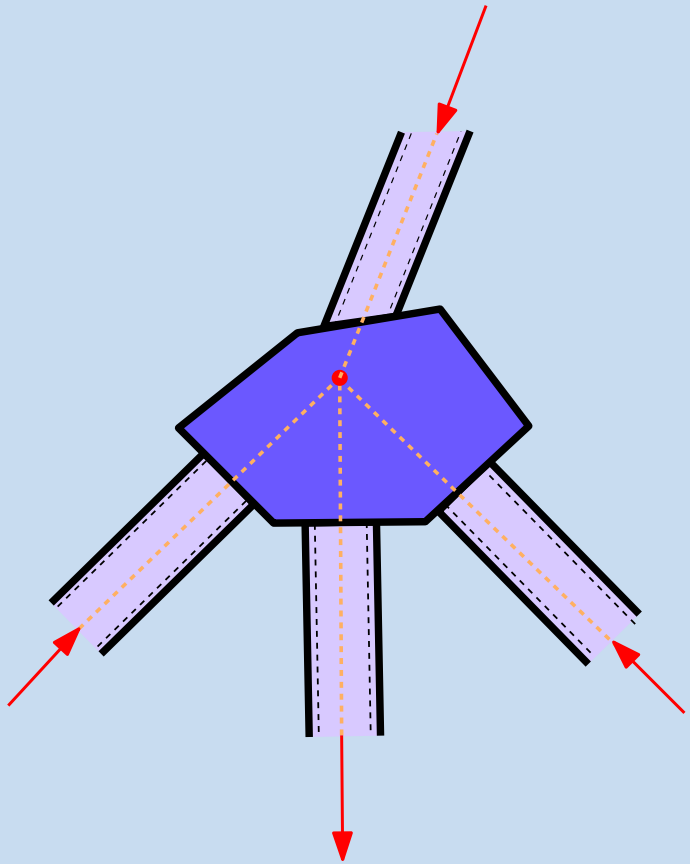

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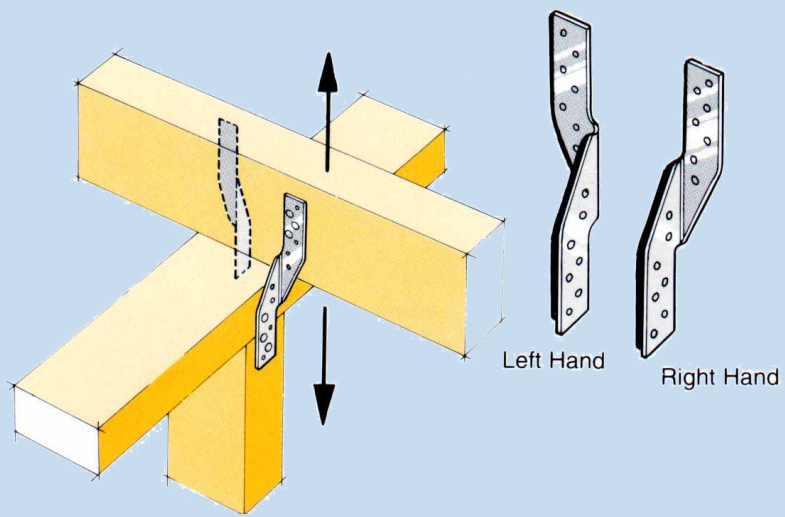

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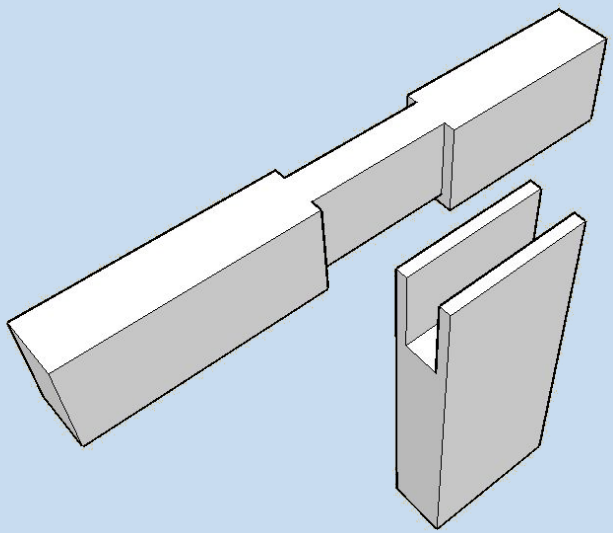

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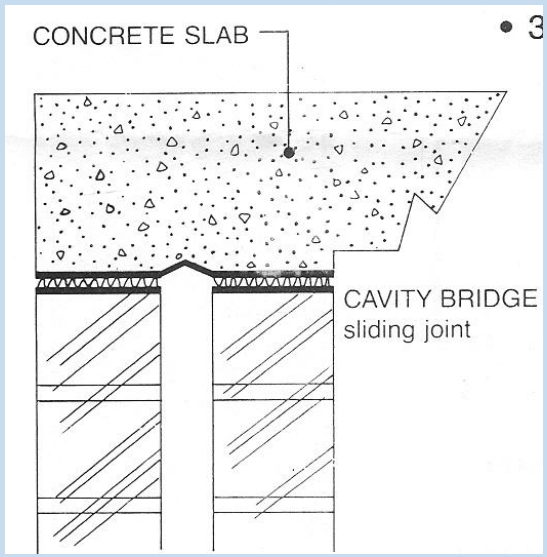

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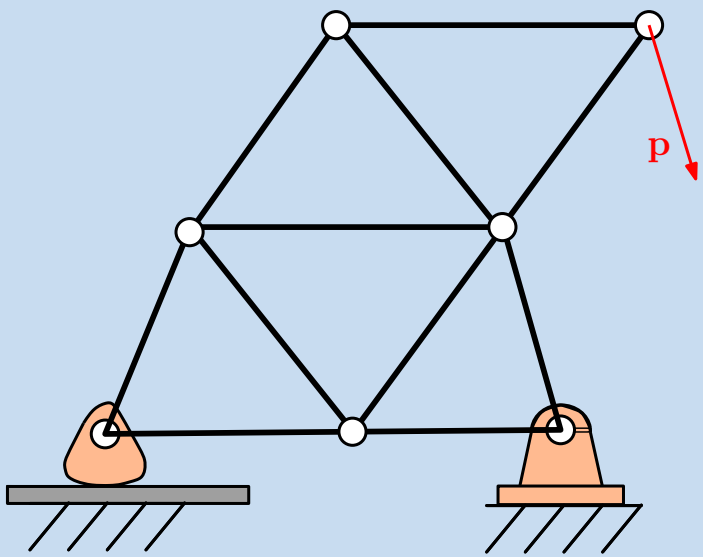

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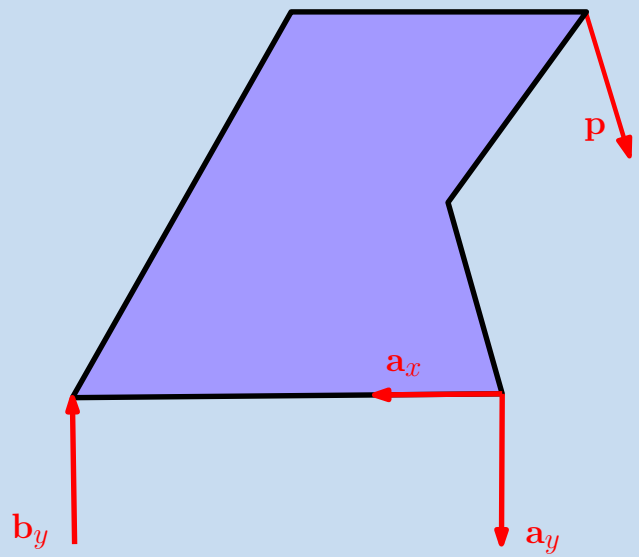

Finally, I corrected it

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Québec Bridge
Vive le Québec libre

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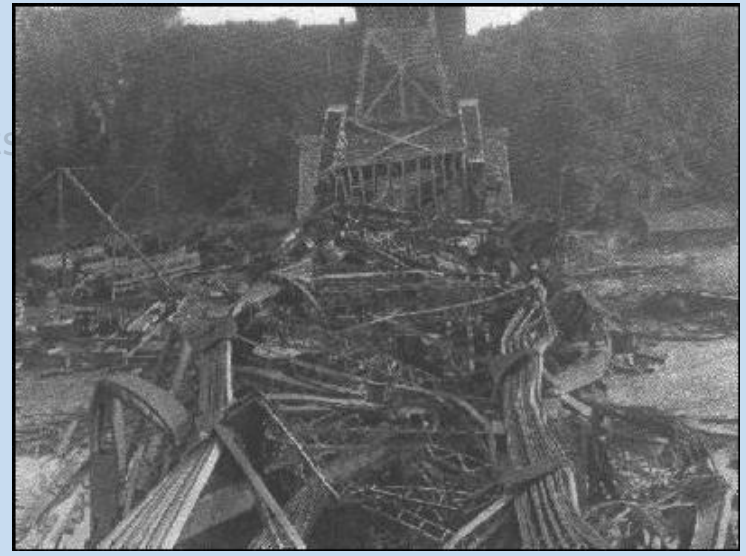

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Like Quebecois, Never Give Up!
3 times collapsed
Quebec Bridge

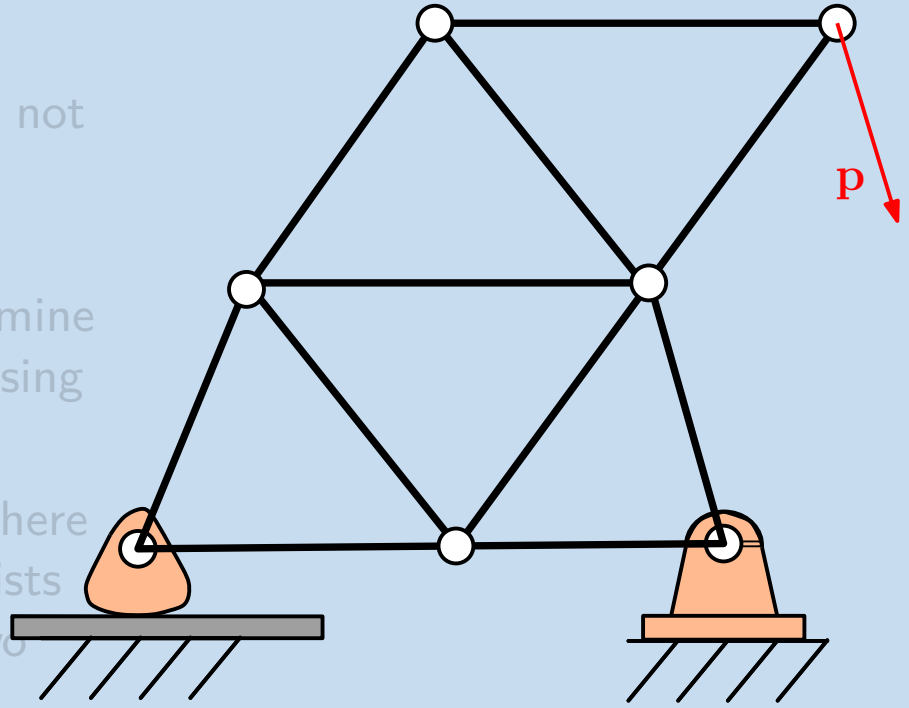
Analysis of Trusses

Method of Joints

1. A truss can be regarded as
   - a group of pines
   - two-forces members

Follow theses steps

1. If the support reactions are not given, draw a FBD of the entire truss
2. From the above FBD determine all the supports reactions using the equations equilibrium.
3. Draw the FBD of a joint where at least one known load exists and where not more tan two unknowns force are present.



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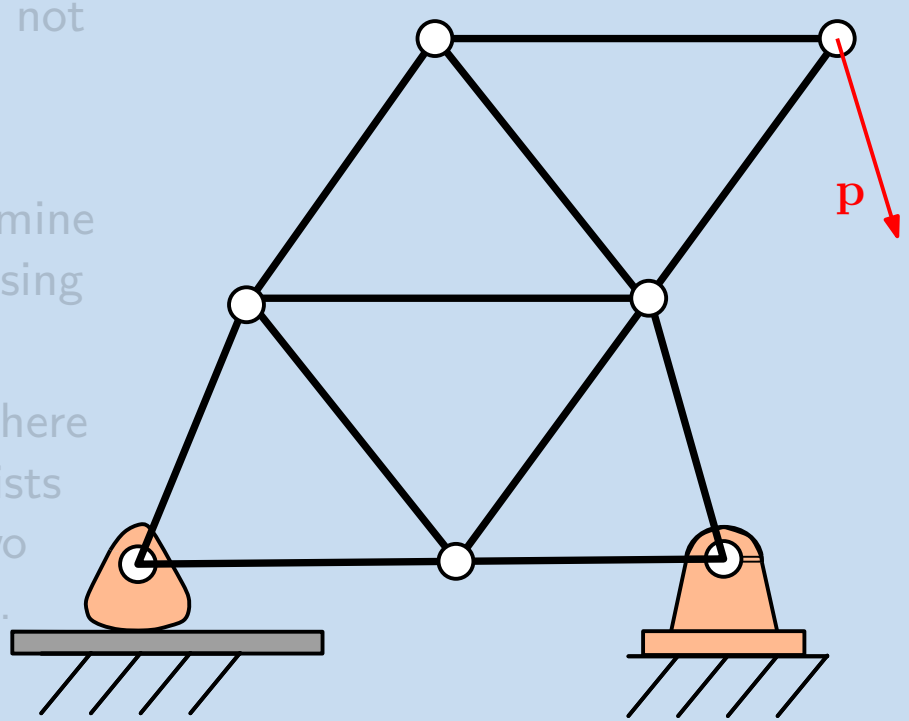

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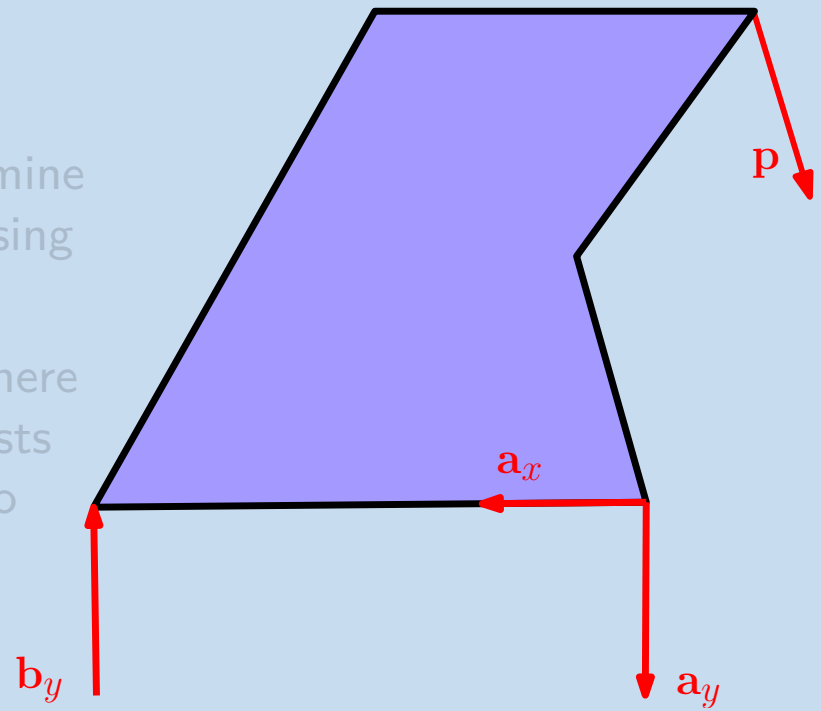

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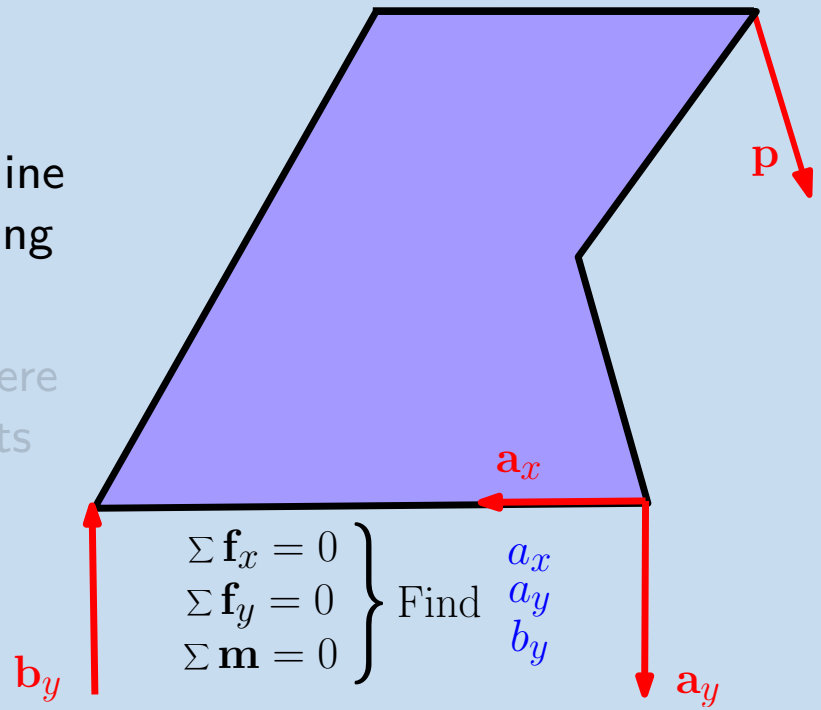

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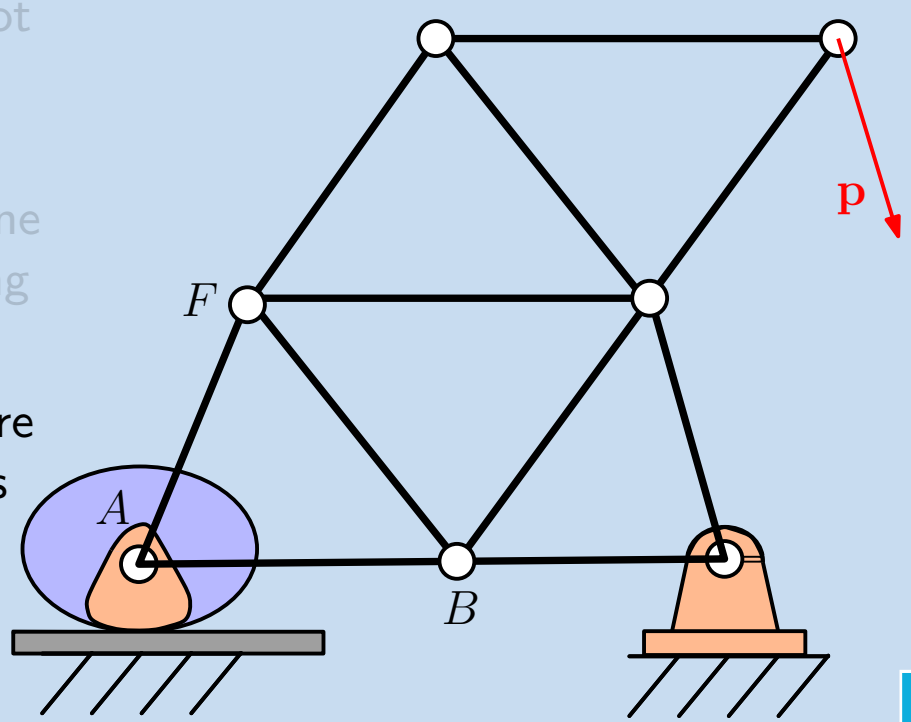

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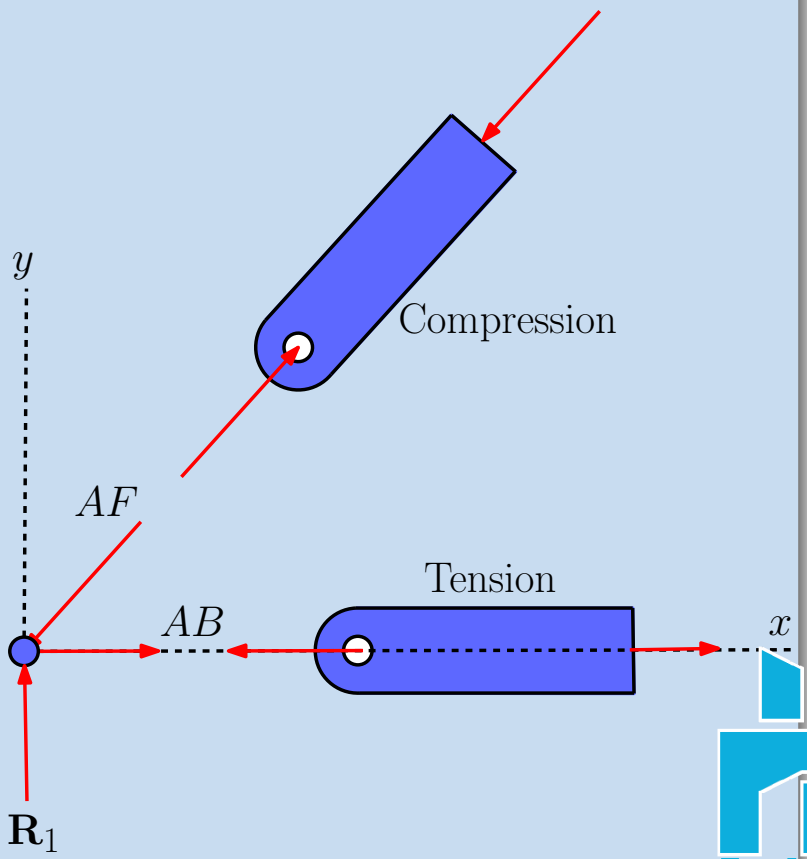

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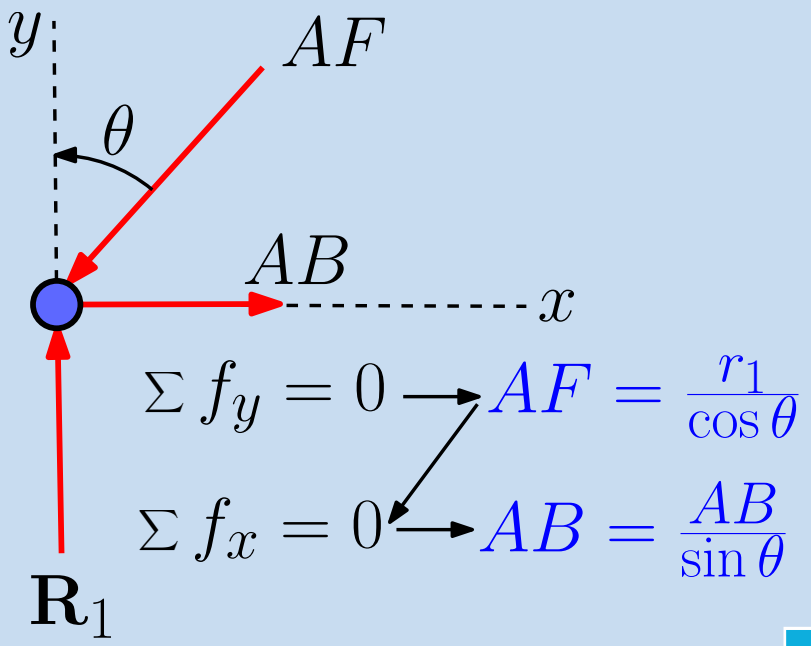

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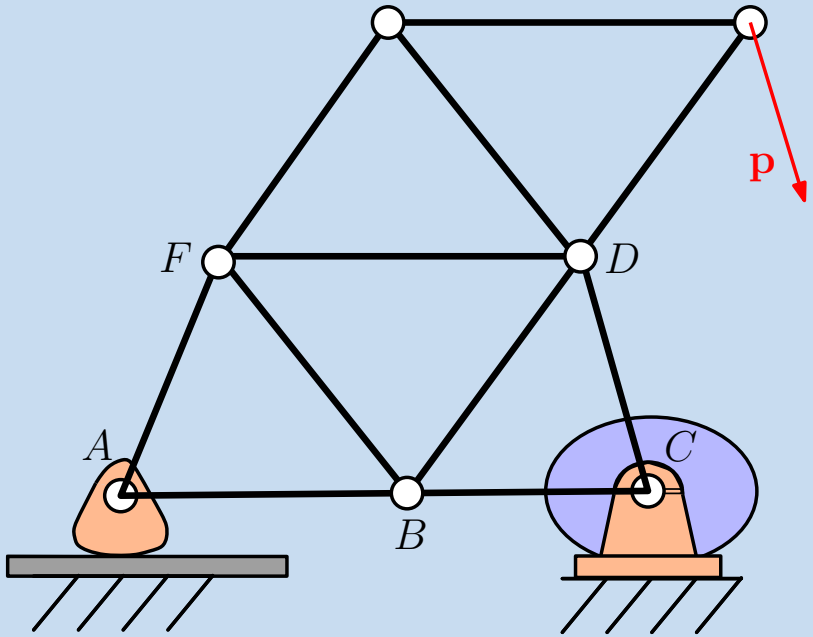

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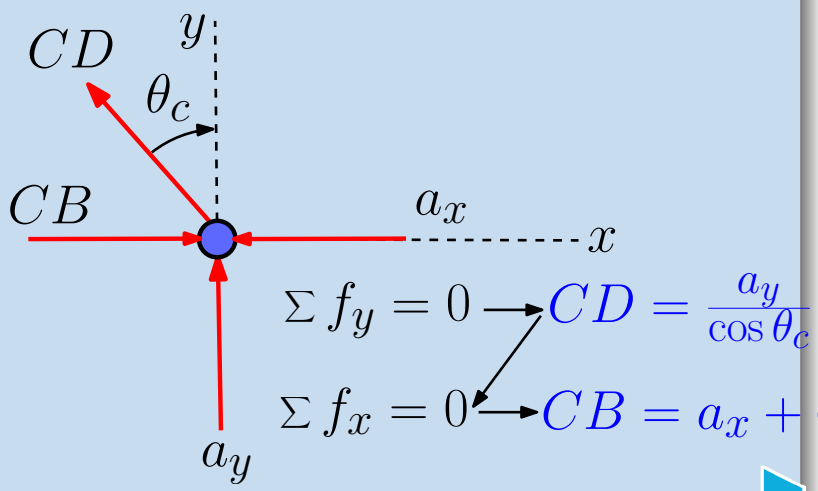

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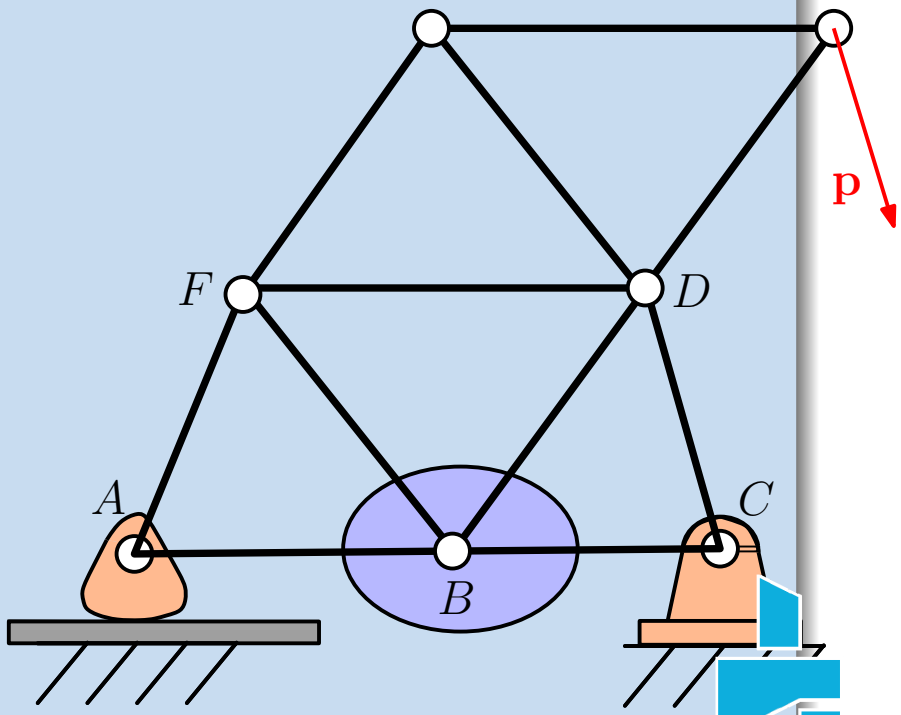

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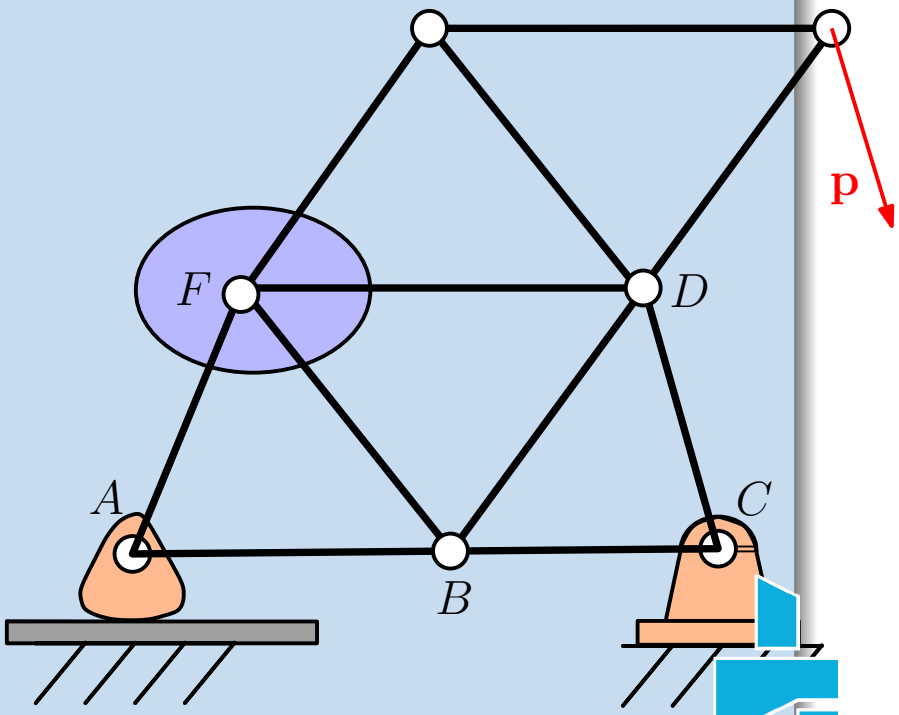

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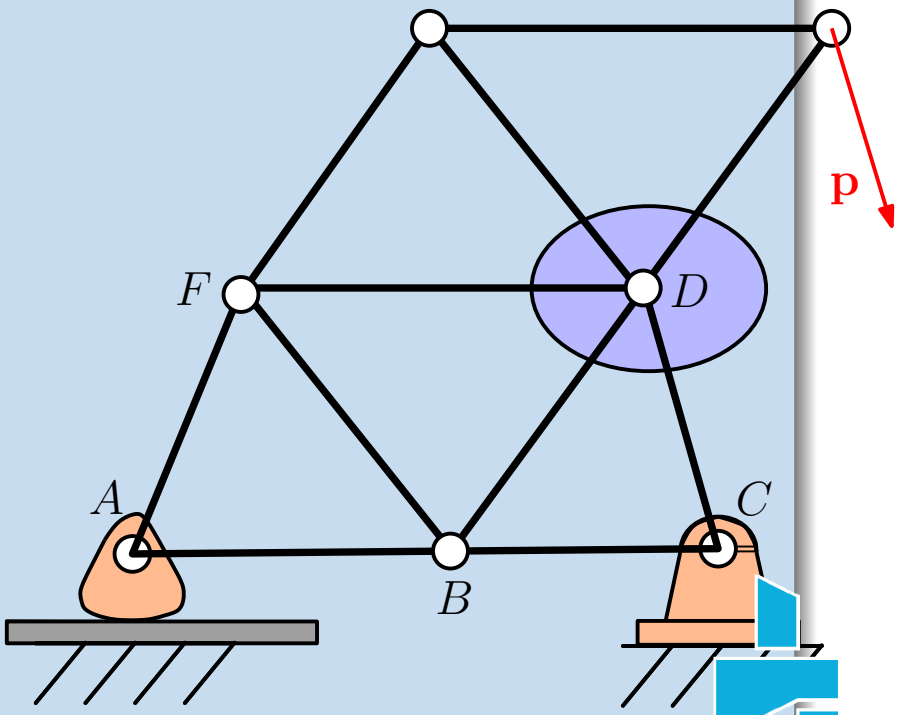

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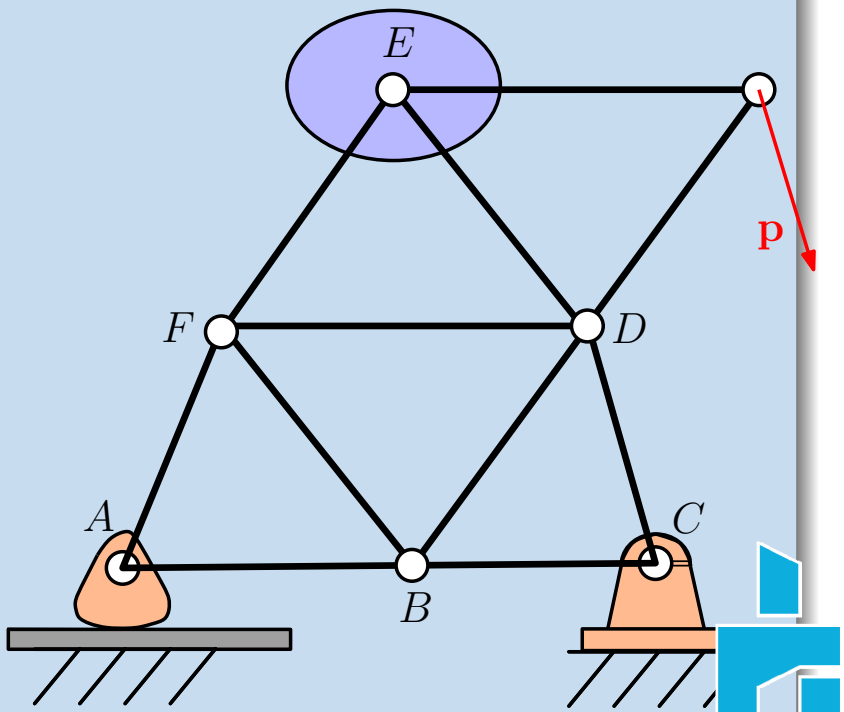

Analysis of Trusses-Method of Joints

Zero-forces Members

1. Zero-forces members can be removed from the analysis
2. First case:
   - The joint has only two non-collinear members
   - There is no external load or support reaction at that joint
3. Second case:
   - Three members form a truss joint
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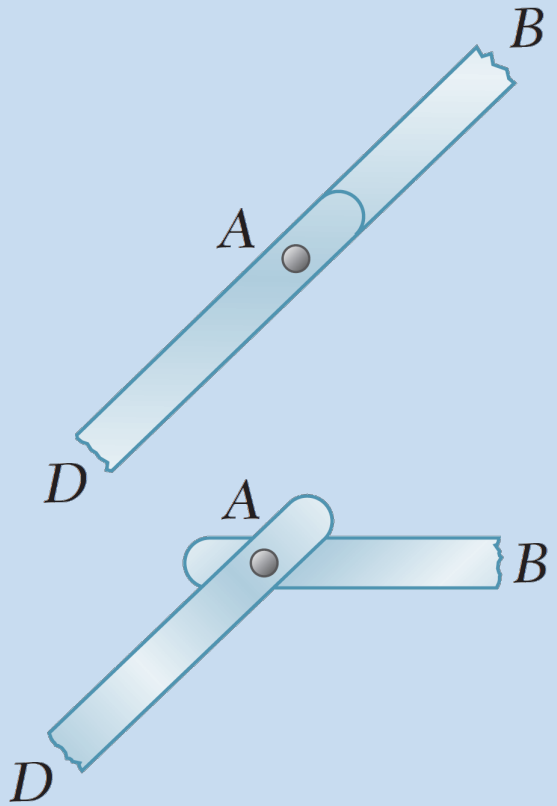

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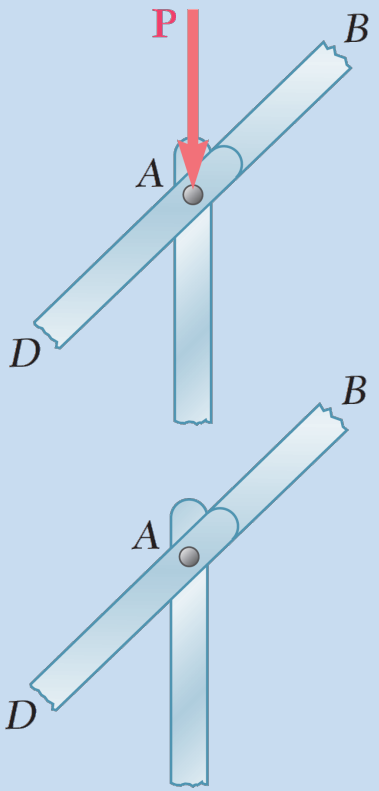

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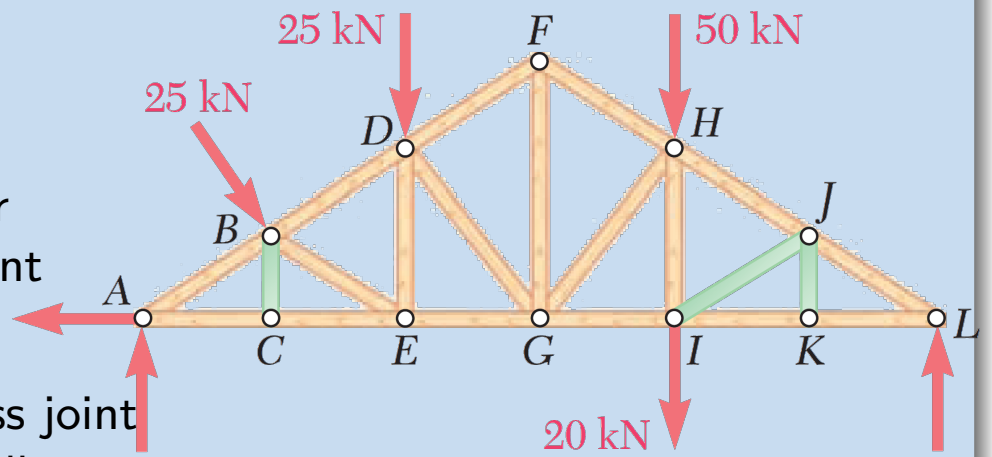

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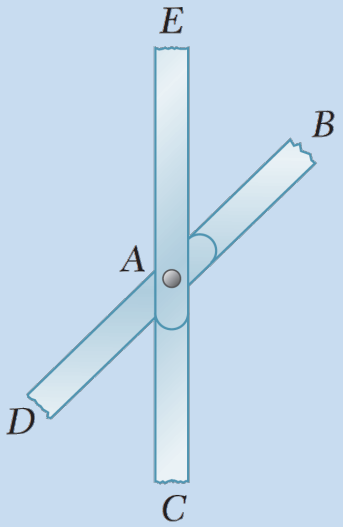
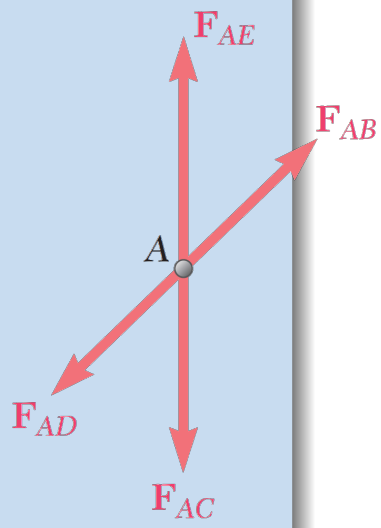


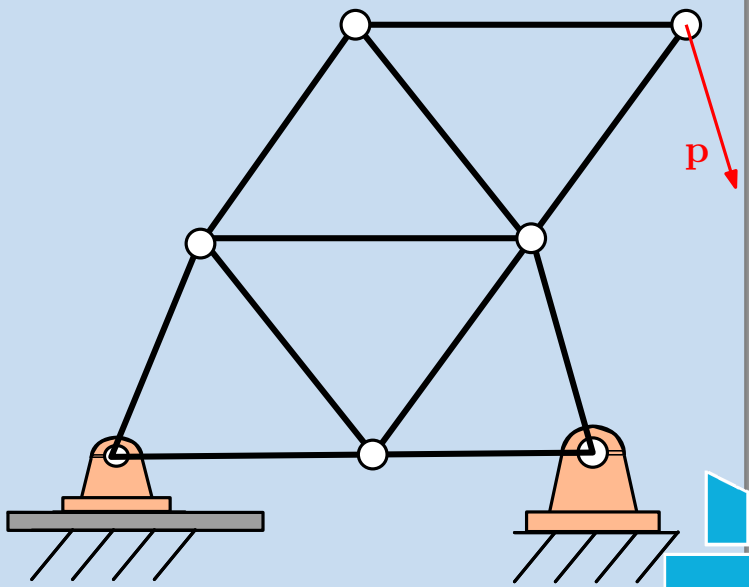


$$F_{AE} = F_{AC}$$
$$F_{AB} = F_{AD}$$

Analysis of Trusses

Internal and external redundancy, (For your exam as true or false)

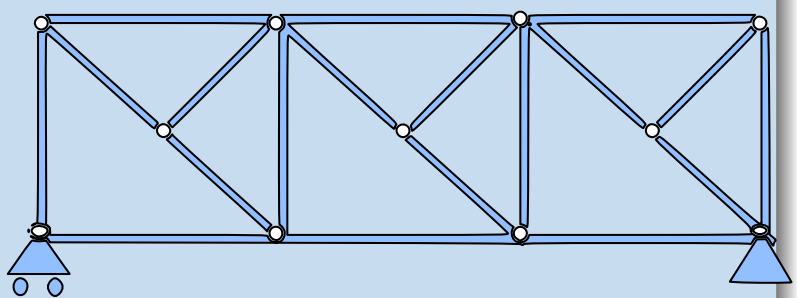
- A statically indetermine truss.
  1. External
  2. Internal
- $m + 3 = 2j$
- Necessary condition (Quiz)
- If $m + 3 > 2j$, more members than independent equations, statically indeterminate internally with redundant members.
- if $m + 3 < 2j$, deficiency of internal members, the truss is unstable and will collapse under load.



Analysis of Trusses

Internal and external redundancy, Some examples

- $m = 19, j = 11$, then $22 = 22$. The truss is statically determine both externally and internally.
- $m = 19 j = 6$, then $12 = 12$. The truss is statically determine both externally and internally.



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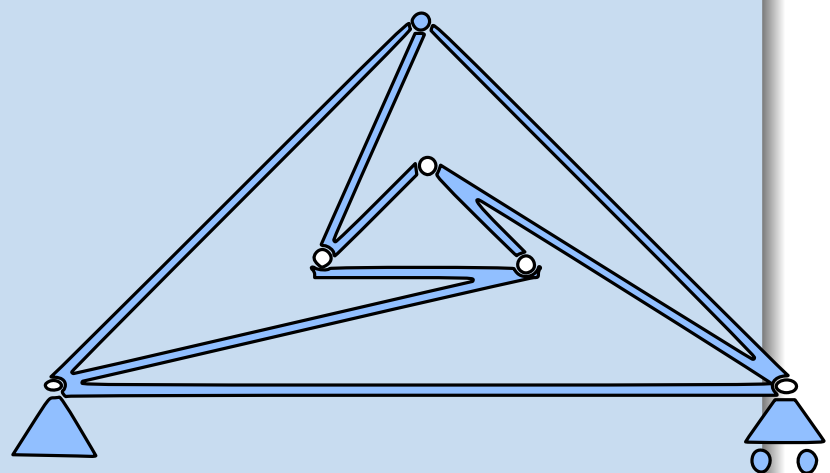
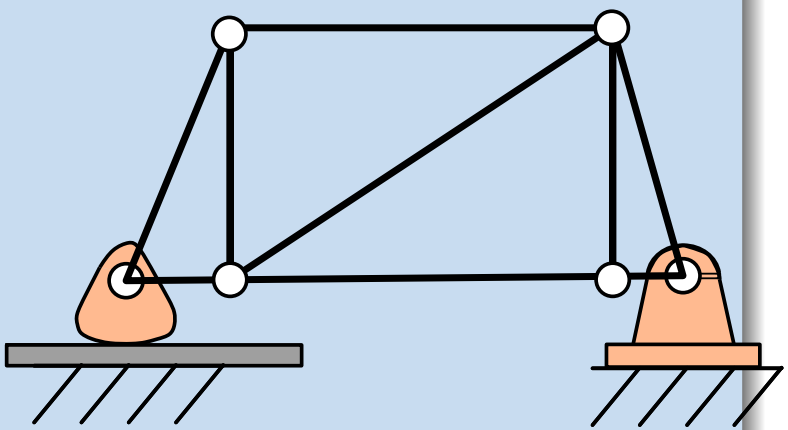


Analysis of Trusses, Methods of Sections

Illustration of the method

- First the external FBD
- Assume an imaginary section
- Divide it into two parts
- Draw the FBD of each part
- Write the equilibrium conditions for each part



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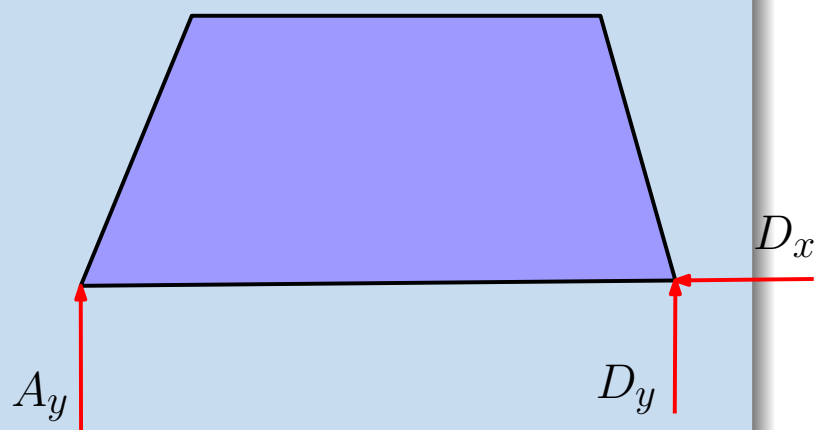

Analysis of Trusses, Methods of Sections

Illustration of the method

- First the external FBD
- Assume an imaginary section
- Divide it into two parts
- Draw the FBD of each part
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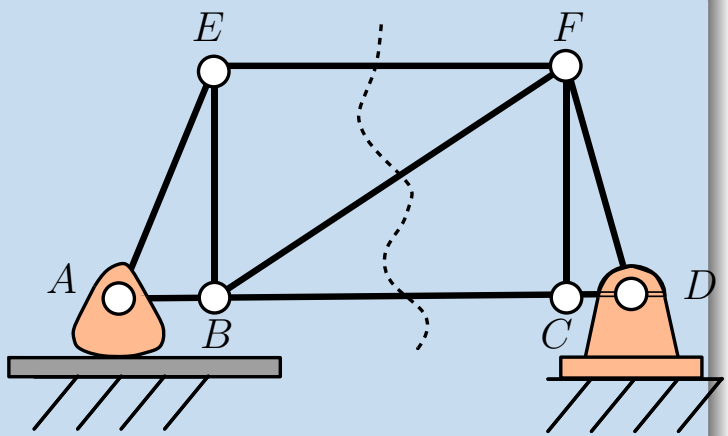

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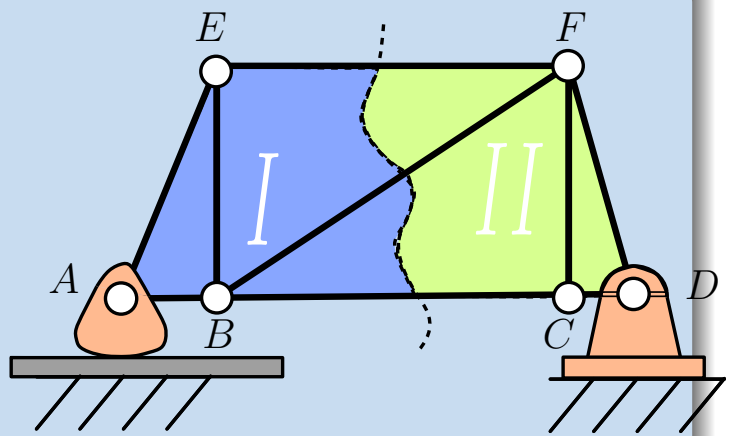

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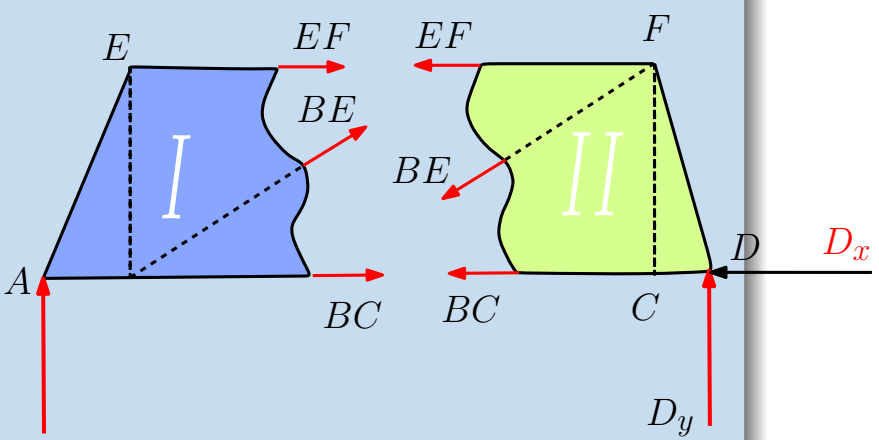

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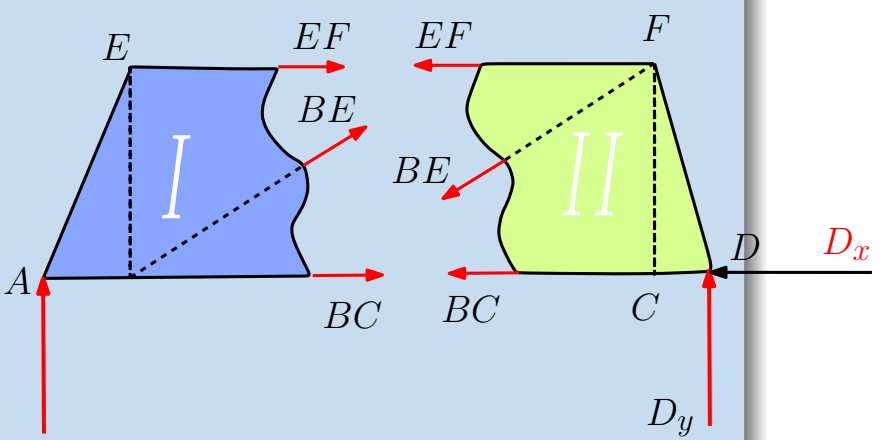

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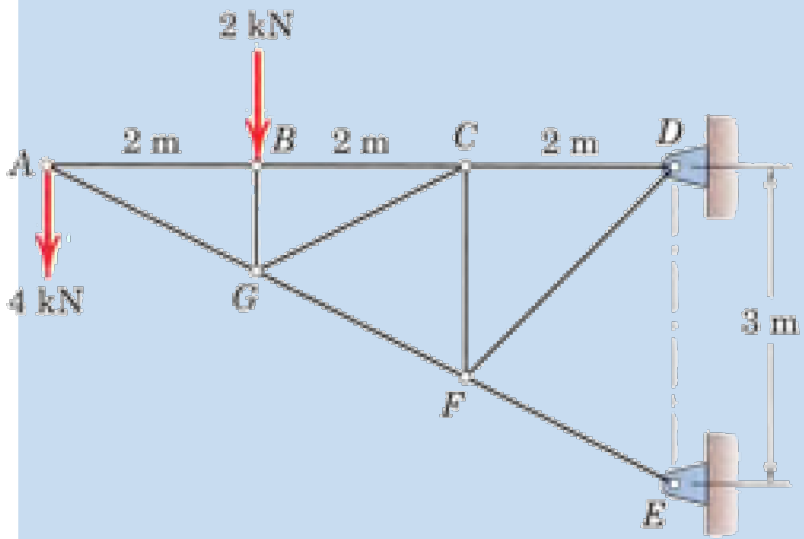
Analysis of Trusses, Method of Joints

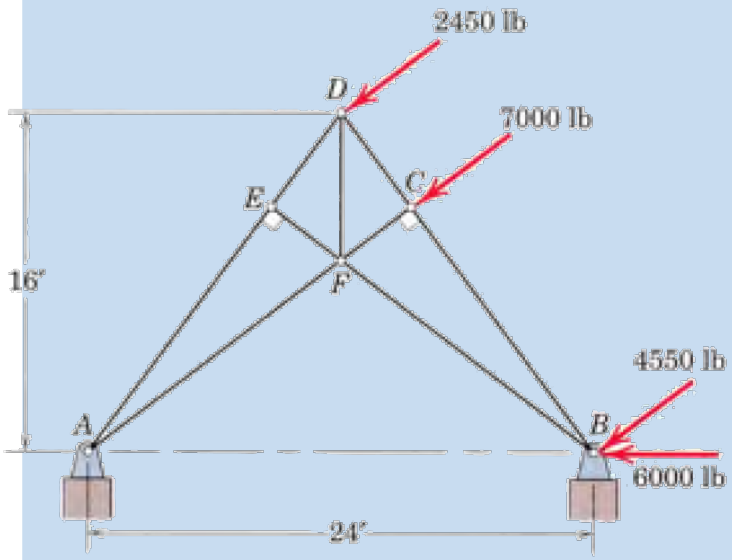
Some examples



- Find CG and CF.
- $m + 3 = 2j$!
- The order of joint: A, B, G and C
- At joint G the coordinate frame is along AF

Analysis of Trusses, Method of Joints

Some examples



- $A_x = 0$
- Find the zero force member

Analysis of Space Trusses, Not Subject of Exam.

Some examples

- A space truss is the three-dimensional counterpart of the plane truss.
- Statically balanced space truss
  1. $m + 6 = 3j$ necessary but not sufficient! Why.
  2. $m + 6 = 3j$ statically indeterminate internally with redundant members.
  3. $m + 6 < 3j$ Deficiency of internal members, subject to collapse.