

LECTURE #8 :

3.11 MECHANICS OF MATERIALS F03

INSTRUCTOR : Professor Christine Ortiz

OFFICE : 13-4022 **PHONE :** 452-3084

WWW : <http://web.mit.edu/cortiz/www>

- Review Trusses : Part 1
- Trusses Part 2 : Methods of Sections and Energy Approach (Castigliano's theorem)

Review Lecture #7 : Trusses Part 1

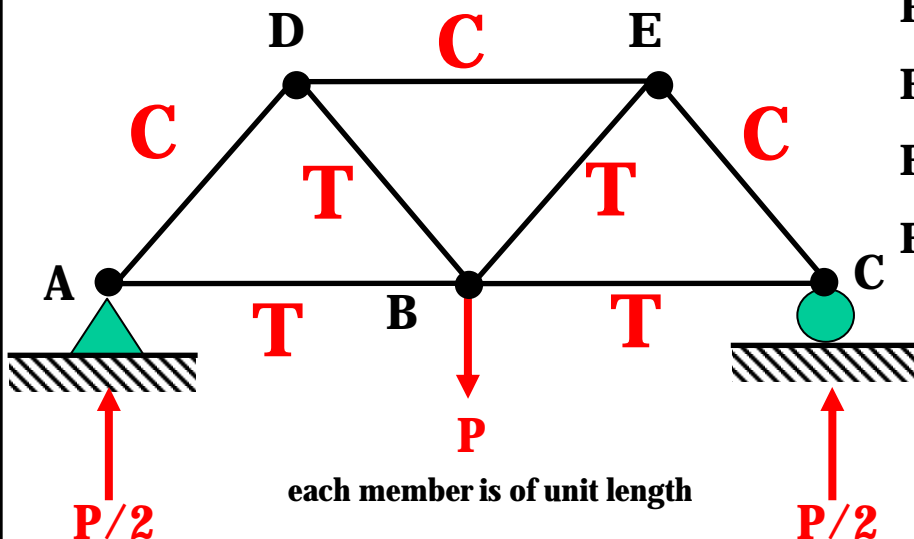
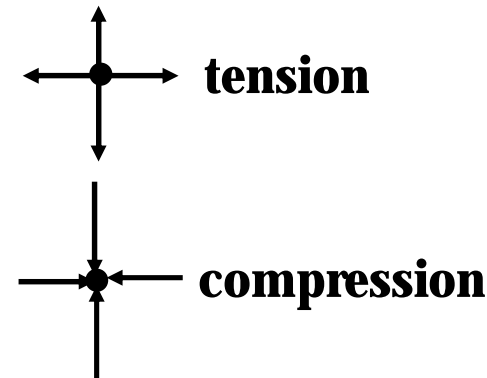
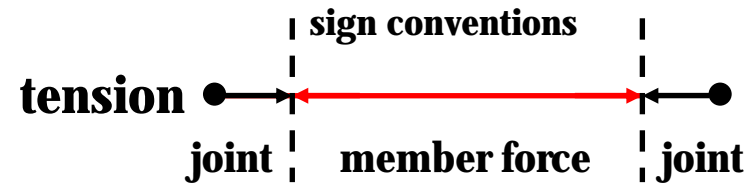
1. TRUSSES : • definitions : joints, members, supports (e.g. pin, roller)

ASSUMPTIONS : • joints are free to rotate, i.e. no moments at joints • all members support either axial tension or compression, i.e. no shear or bending

A. To determine member forces :

METHOD OF JOINTS :

1. Draw a free-body diagram of the entire truss
2. Determine support reactions using the equations of static equilibrium :
 $\Sigma F_X=0, \Sigma F_Y=0, \Sigma M_{XY}=0$
3. Identify a joint where you know the maximum amount of forces (e.g. a support with two members)
4. Draw a free-body diagram of the joint and determine whether forces are compressive or tensile
5. Write and solve equations of static equilibrium* for diagram drawn in step 4
6. Move to an adjacent joint and repeat steps 4-5 until entire truss is solved

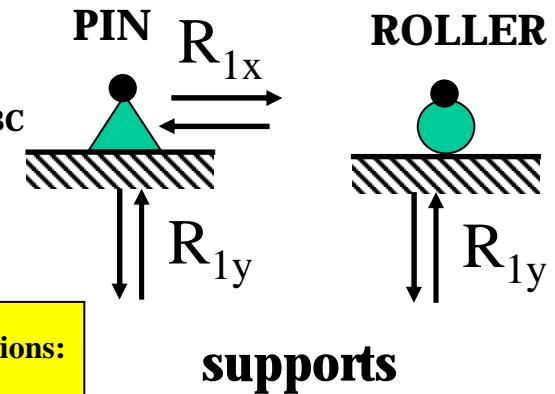
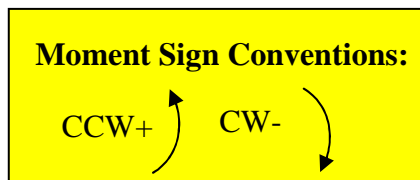


$$F_{AD} = P / 2 \sin 60$$

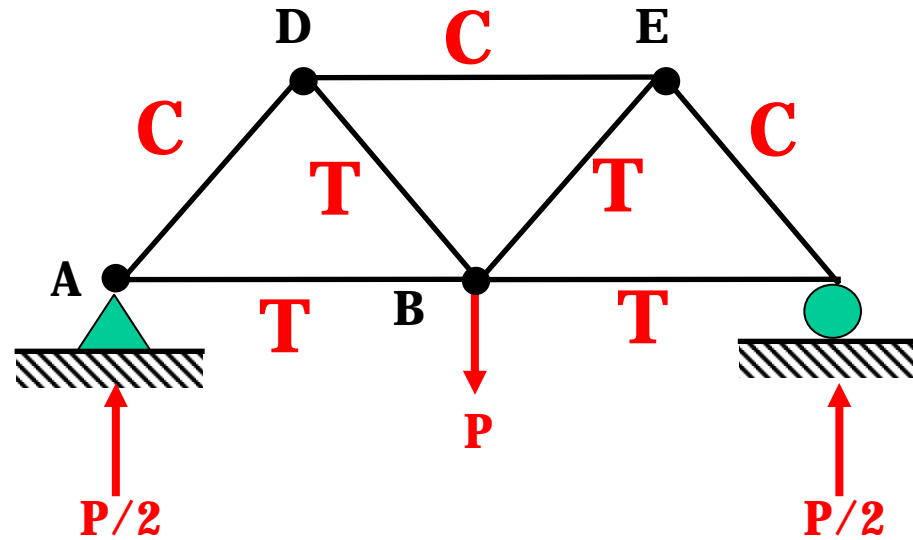
$$F_{AD} = F_{DB} = F_{BE} = F_{EC}$$

$$F_{AB} = P \cos 60 / 2 \sin 60 = F_{BC}$$

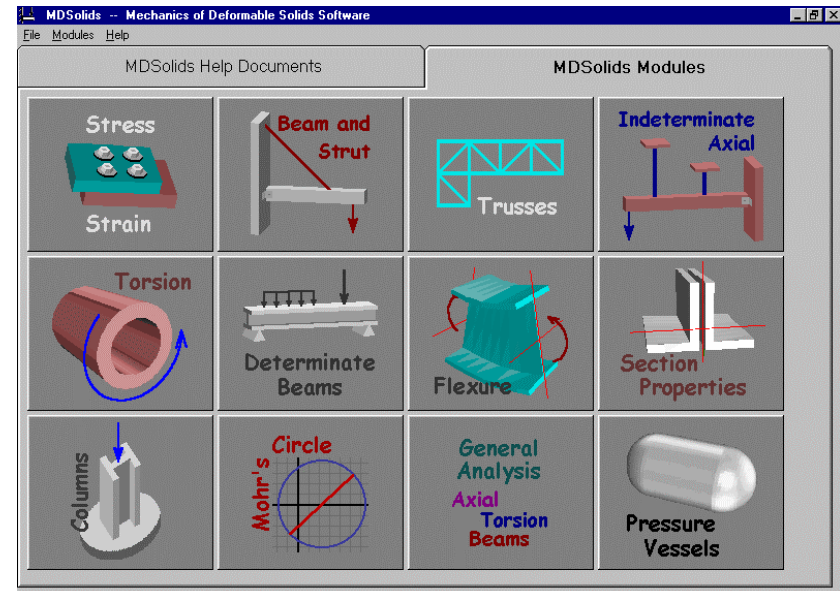
$$F_{DE} = P \cos 60 / \sin 60$$



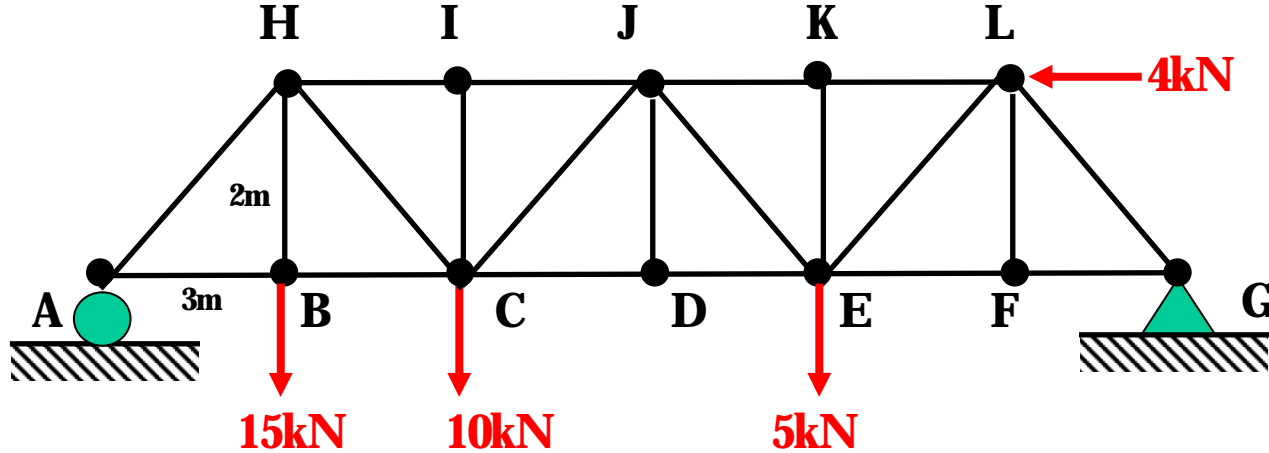
Solving Sample Problem #1 with MDSolids



- go to modules / trusses
- click on “new truss”
- create grid : x-direction 0.5, y-direction 0.866 (to get correct geometry, members of unit length) number of spaces =5 for both
- create truss
- add supports
- add loads
- hit compute
- to redo same truss hit “edit”

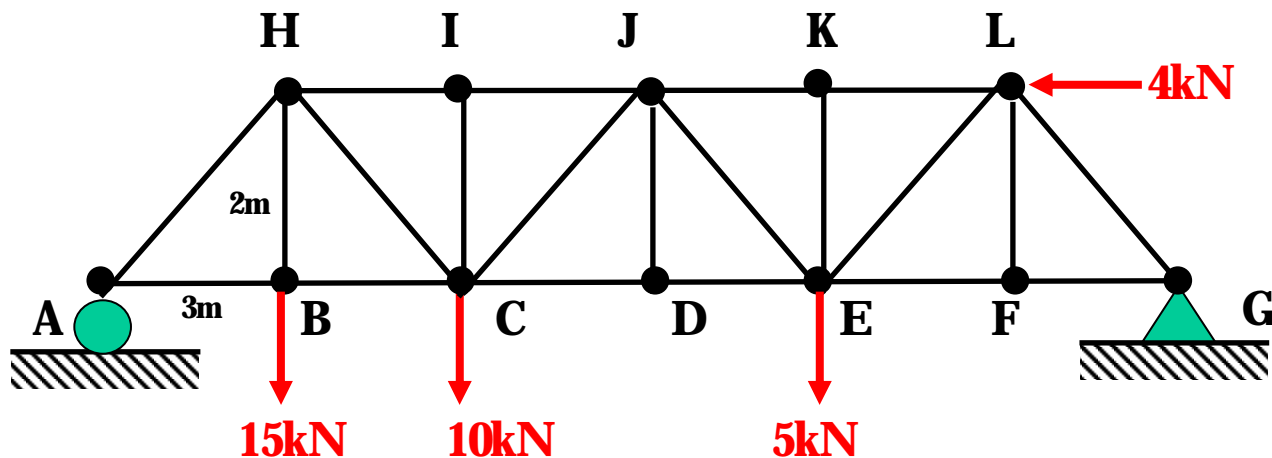


Trusses : Method of Sections : Sample Problem #2



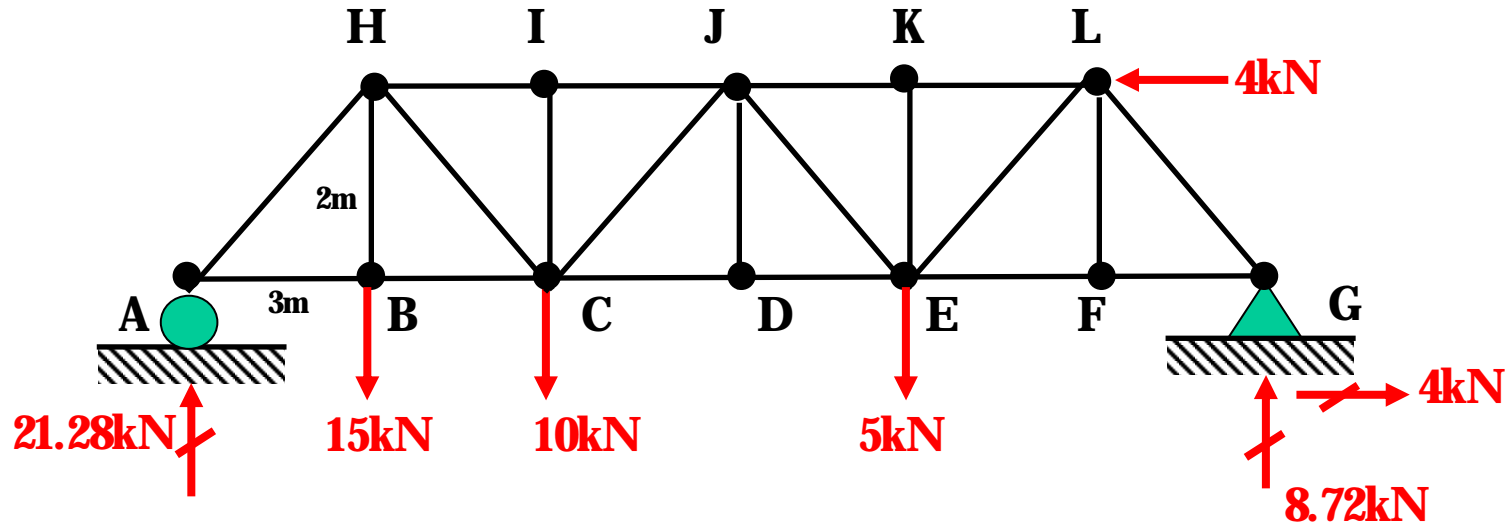
Trusses : Method of Sections : Sample Problem #2

Find F_{JC}



1. Draw a free-body diagram of the entire truss
2. Determine support reactions using the eqs of static equilibrium

Trusses : Method of Sections : Sample Problem # 2 Find F_{JC}

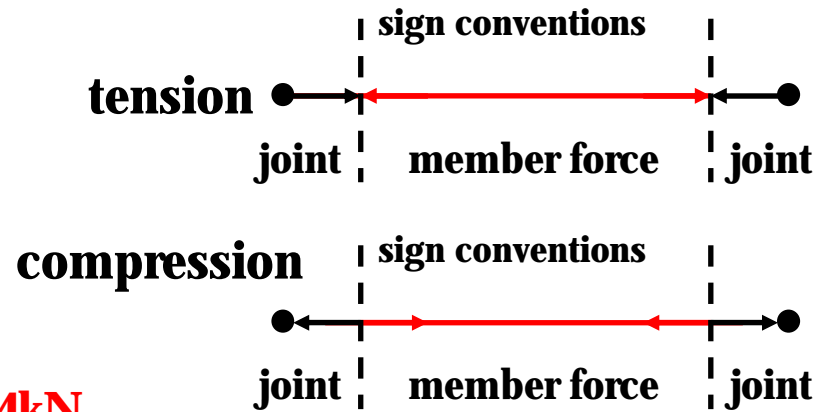
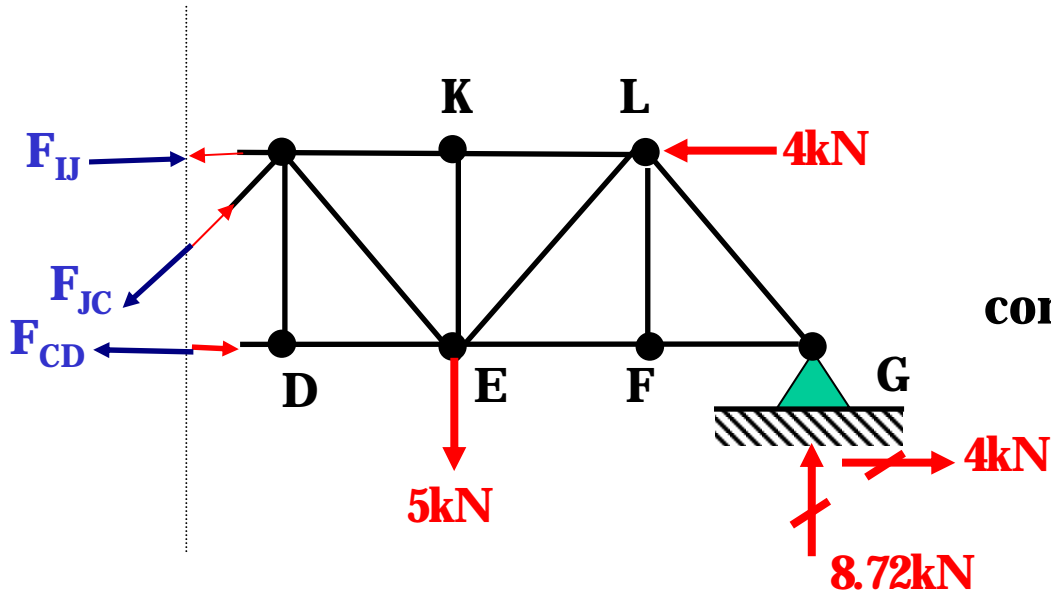


3. Identify members to be analyzed

4. Cut a section through the members of interest (maximum three)

Trusses : Method of Sections : Sample Problem # 2 Find F_{JC}

5. Isolate smaller part of truss and draw free-body diagram



Elastic Strain Energy for Solving Deflections in Truss Problems

Castigliano's Theorem for Solving Deflections in Truss Problems

Using Castigliano's Theorem for Solving Deflections in Truss Problems
