

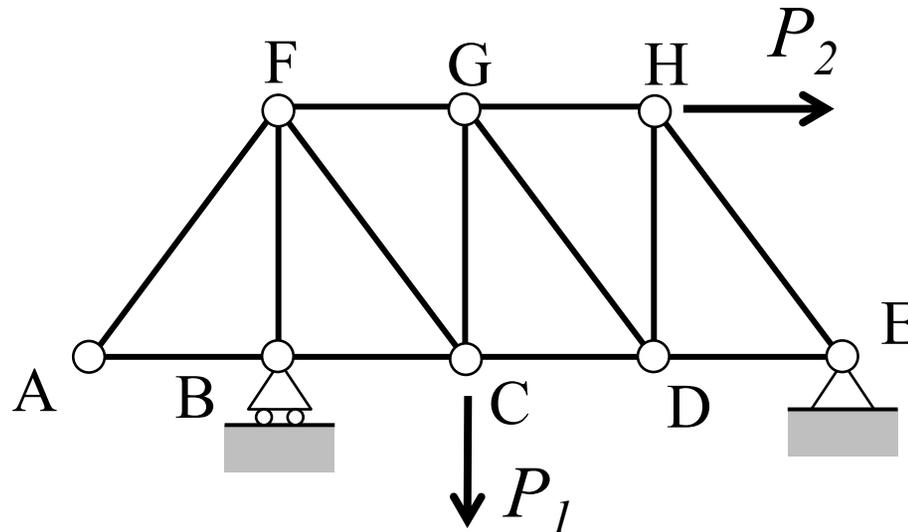
Determinacy for Planar Trusses

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Assessing the Determinacy of a Planar Truss

Consider the stable simple truss

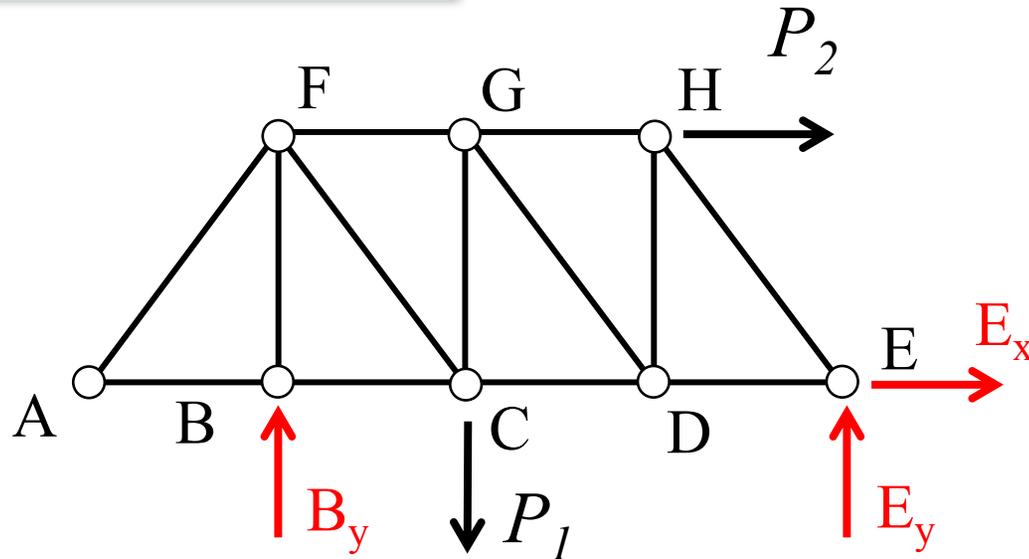


1. All truss connections are idealized as frictionless pins;
2. All loads to the truss are point loads applied at the truss joints;
3. Weight of the truss members is small compared to joint loads and internal axial force that can be carried by the member.

Recall that due to our three assumptions, each truss member is a two-force member and carries only axial force.

Assessing the Determinacy of a Planar Truss

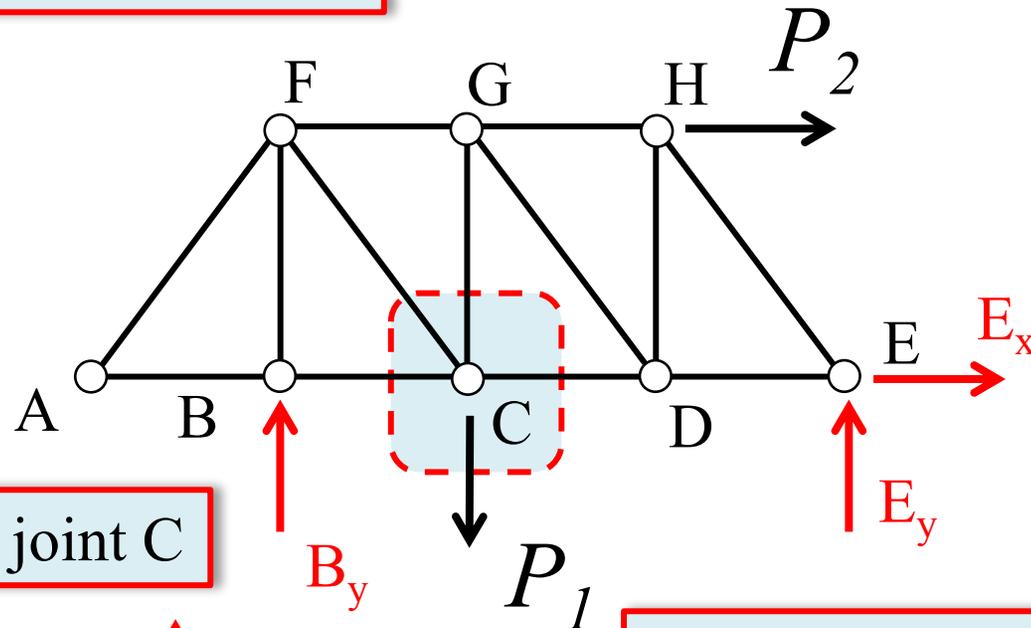
FBD of the entire truss



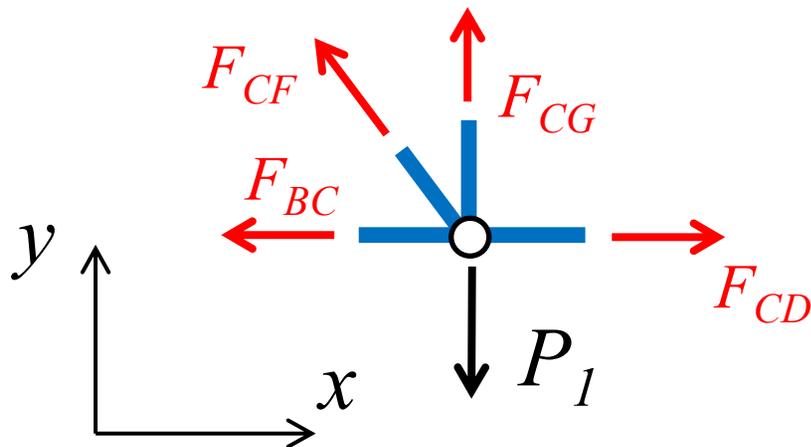
The truss support reactions are unknown, and since the truss members carry only axial force there is one unknown internal force per truss member.

Assessing the Determinacy of a Planar Truss

FBD of the entire truss



FBD of the joint C



Two equations of equilibrium are available per truss joint to find unknowns.

$$\sum F_x = 0 \quad \sum F_y = 0$$

Assessing the Determinacy of a Planar Truss

In order to accurately count the total number of unknowns in a truss we must first cut the truss at all supports (e.g. pins, rollers, fixed supports) and draw a FBD of the entire truss.

Let:

b = total number of truss members;

r = total number of truss reactive forces;

j = total number of truss joints;

then;

$b + r$ = total number of unknown in the truss analysis problem;

$2j$ = total number of independent equations of equilibrium available to solve for unknowns;

For a stable planar truss, if:

$$b + r = 2j$$

Then the truss is **Statically Determinate**.

Assessing the Determinacy of a Planar Truss

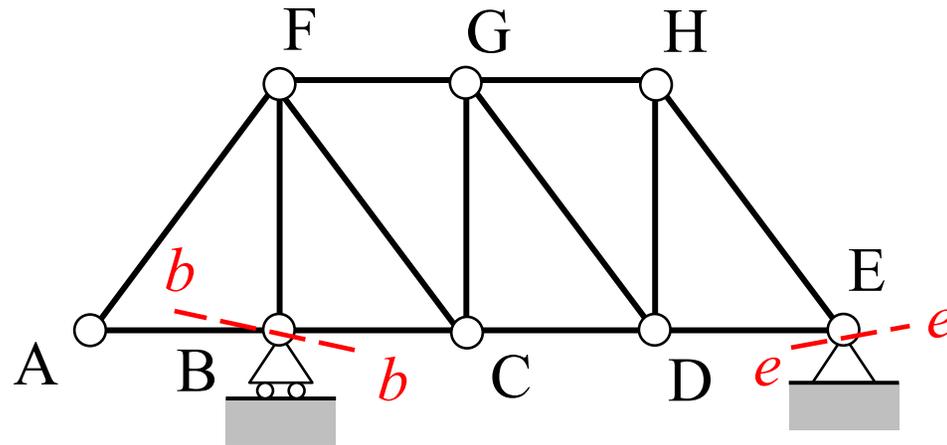
For a stable planar truss, if:

$$b + r > 2j$$

then the truss is **Statically Indeterminate** and the degree of indeterminacy is:

$$(b + r) - 2j$$

Consider our Example Truss



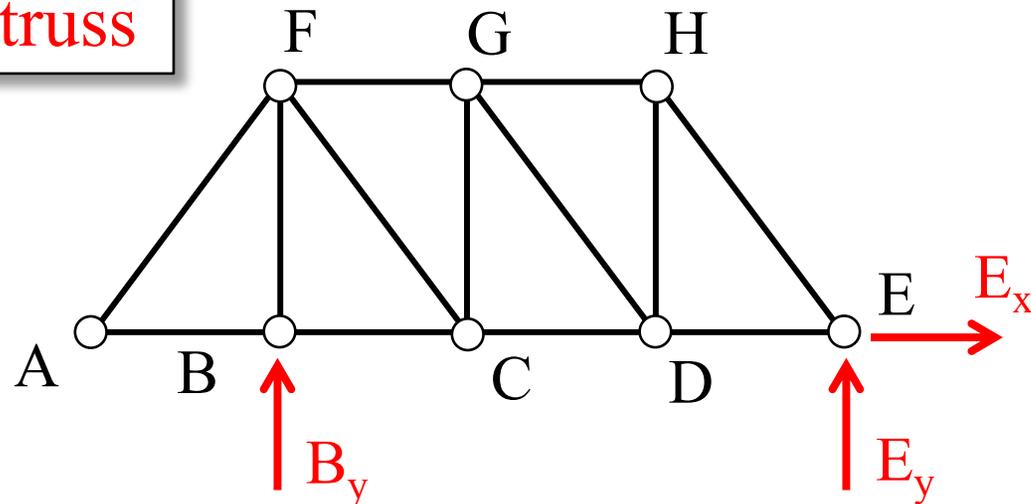
FBD of entire truss

$$b = 13$$

$$r = 3$$

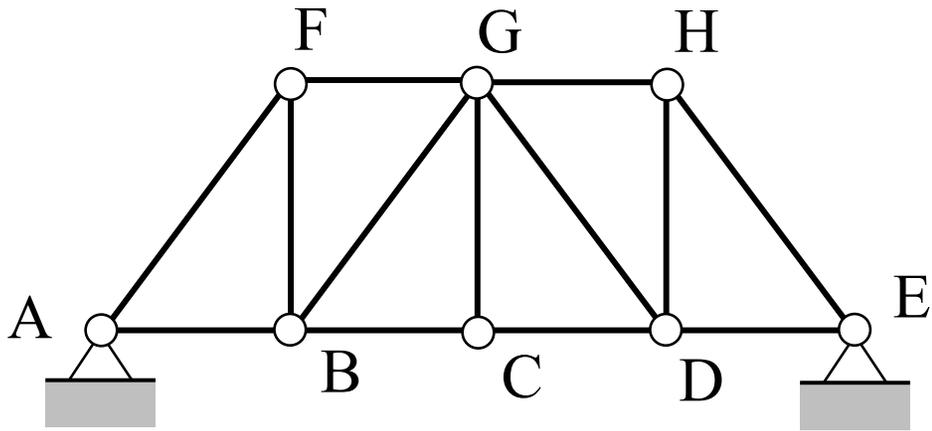
$$13 + 3 = 16$$

$$2j = 2(8) = 16$$



Truss is Statically Determinate

Another Example



The stable truss shown has pin supports at A and E. Assess the determinacy of the truss.

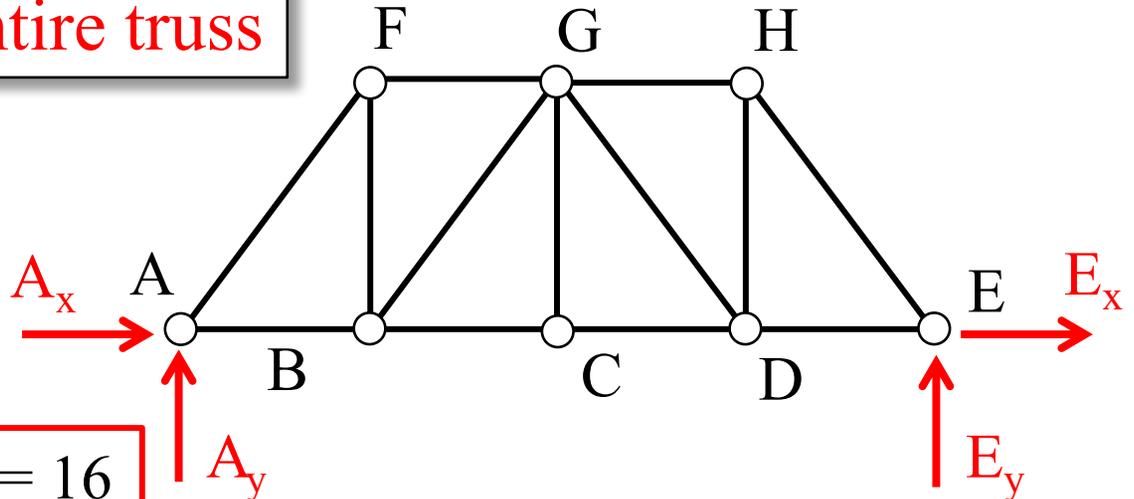
FBD of entire truss

$$b = 13$$

$$r = 4$$

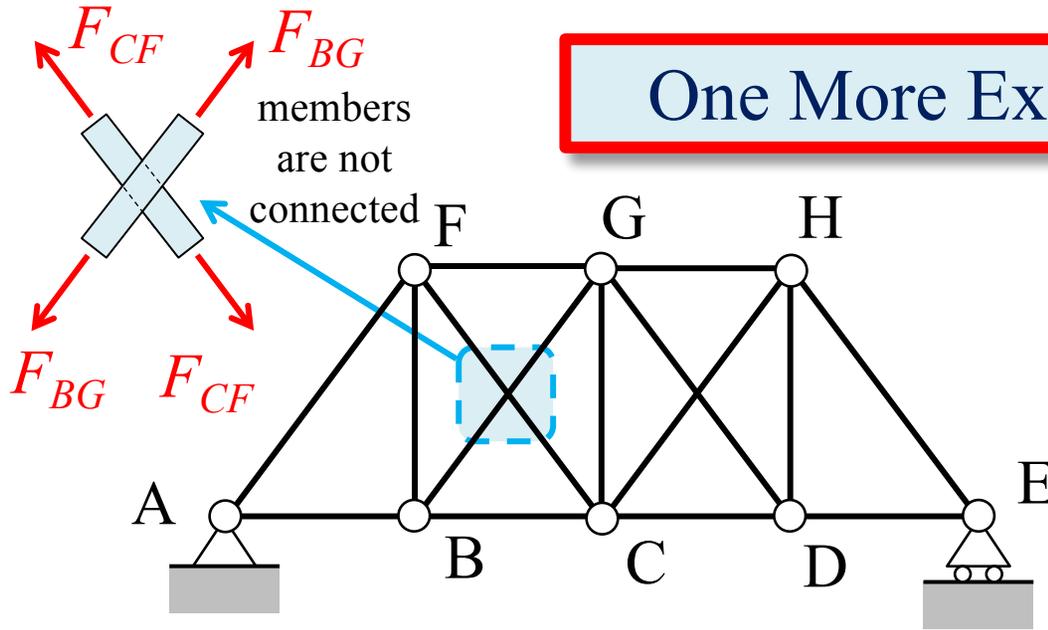
$$2j = 2(8) = 16$$

$$13 + 4 = 17$$



Truss is Statically Indeterminate to the 1st degree

One More Example



The stable truss shown has a pin support at A and a roller support at E. Assess the determinacy of the truss.

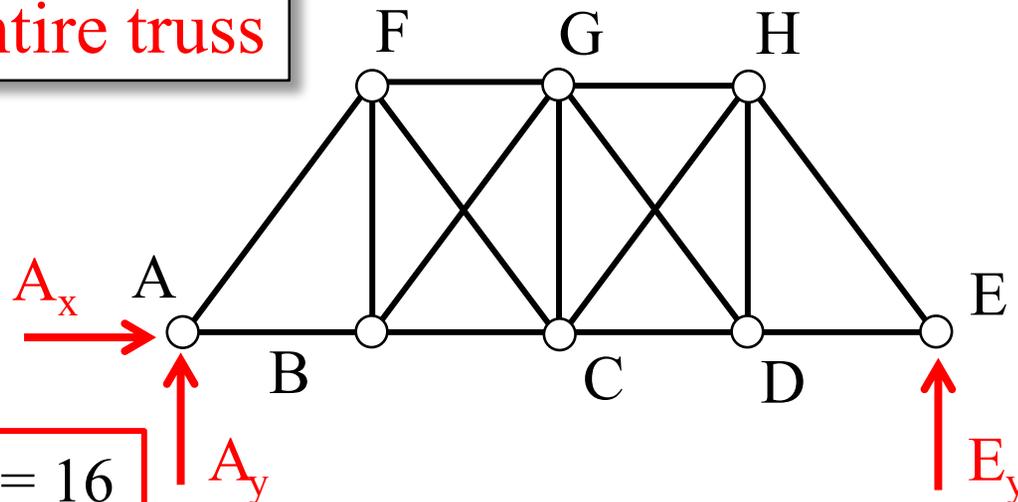
FBD of entire truss

$$b = 15$$

$$r = 3$$

$$2j = 2(8) = 16$$

$$15 + 3 = 18$$



Truss is Statically Indeterminate to the 2nd degree

Recall that Determinacy is Only Applicable to Stable Structures

As noted previously in the assessment of general structures, determinacy is defined only for stable structures. The process for assessment is as follows:

