6.1 Method of joints

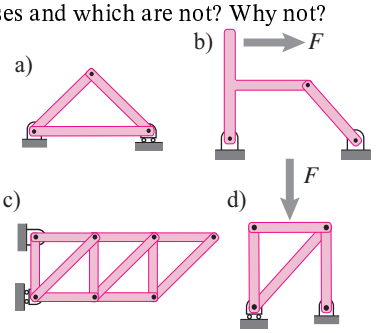
Preparatory Problems

6.1.1 Define these terms: a) truss, b) ideal truss, c) bar, d) joint, e) load, f) "bar force", g) bar tension, h) bar compression, i) reaction, j) roller support and k) pin support.

6.1.2 Name as many positive attributes of trusses as you can.

6.1.3 Name as many negative attributes of trusses as you can.

6.1.4 Which of the structures below are trusses and which are not? Why not?



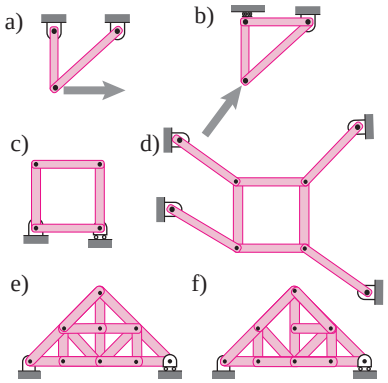
Problem 6.1.4

6.1.5 Consider this formula

$$b + r = 2j$$

a) What do b, r, and j stand for?
b) What is the use of this formula?
c) What is the source of this formula?

6.1.6 For each of the trusses below: **i)** What are b, j, and r? **ii)** What does the formula $b + r = 2j$ tell you ?

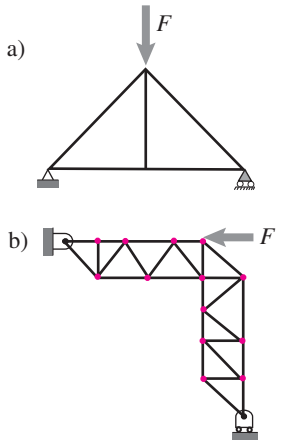


Problem 6.1.6

6.1.7 For a given truss you are told values for b, j, and r.

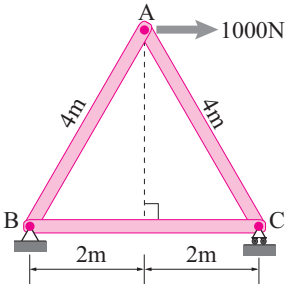
a) When solving the truss how many unknowns are you trying to solve for?
b) How many independent scalar equations do you have from using the method of joints on the whole structure?

6.1.8 Find the zero-force members in the trusses below.



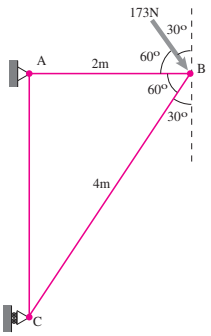
Problem 6.1.8

6.1.9 What is the tension in bar AC. *



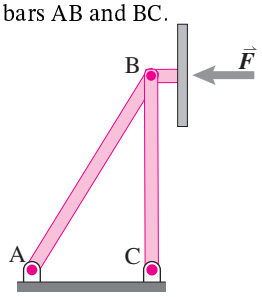
Problem 6.1.9

6.1.10 The only force acting on the negligible-weight truss ABC is the 173 N force shown. Find the tension in the bar AB. *



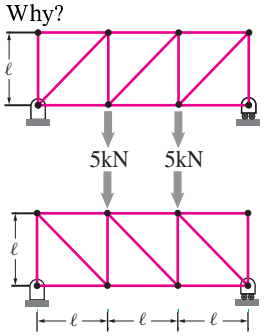
Problem 6.1.10

6.1.11 A billboard is supported by a two bar truss as shown in the figure. The two bars have pin joints at A, B, and C. Angle ABC is 30°. The total wind load on the board is estimated to be 300 N, find the forces in bars AB and BC.



Problem 6.1.11

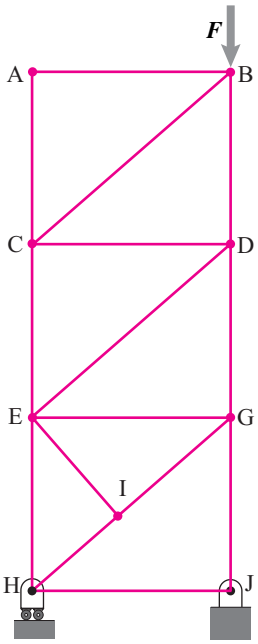
6.1.12 Find the support reactions for the two trusses without any (written) calculations. Should the support reactions be different? Why?



Problem 6.1.12

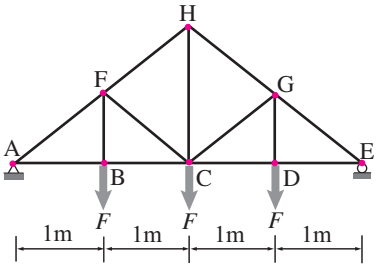
More-Involved Problems

6.1.13 Sketch the truss below. Write a big clear zero on top of each of the zero-force members. *



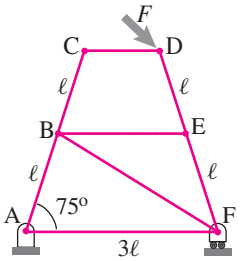
Problem 6.1.13

6.1.14 Find the support reactions on the truss shown in the figure taking $F = 5\,\text{kN}$.



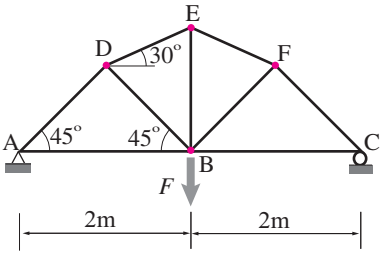
Problem 6.1.14

6.1.15 Find the support reactions at A and F for a load $F = 3\,\text{kN}$ acting at D at 45° with respect to CD, if $\ell = 1\,\text{m}$ and $\theta = 75^\circ$. How will the support reactions change if bar BF was removed and used to connect joints A and E instead of B and F?



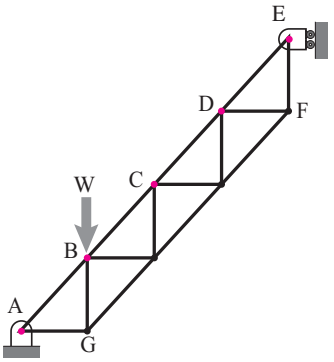
Problem 6.1.15

6.1.16 How do the support reactions on the truss shown in the figure change if the load at point B is replaced by three equal loads, $F/3$ each, acting at points D, E, and F?



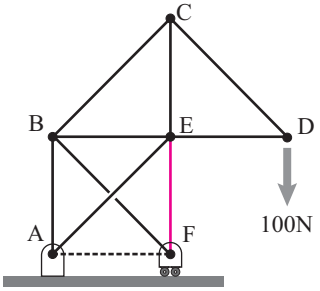
Problem 6.1.16

6.1.17 The stairstep truss shown in the figure has 500 mm long horizontal and vertical bars. Find the support reactions at A and E when a load $W = 1\,\text{kN}$ is applied at (a) point B, (b) point C, and (c) point D, respectively.



Problem 6.1.17

6.1.18 In the truss shown in the figure, how does the force in bar EF change if the diagonal bar BF is removed and another bar AF (shown by dotted line) is introduced instead? You can assume any reasonable dimensions for the bars if needed.



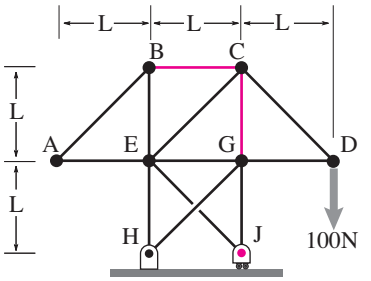
Problem 6.1.18

6.1.19 For the truss shown, find:

a) The reaction at J.

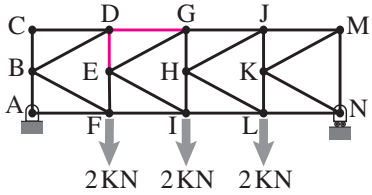
b) The bar force in BC (tension or compression).

c) The force in bar CG (tension or compression).



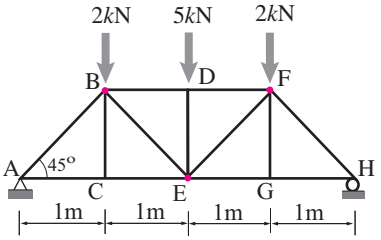
Problem 6.1.19

6.1.20 The truss shown in the figure consists of 4 square bays of a 'K' structure. Each bay has two 2 m long horizontal, two 1 m long vertical bars, and two diagonal bars. Find the tensions in rods DE and DG.



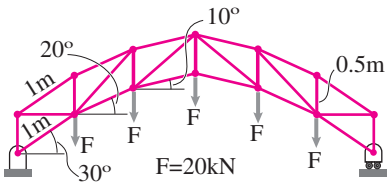
Problem 6.1.20

6.1.21 Analyze the truss shown in the figure and find the forces in all the bars.



Problem 6.1.21

6.1.22 Analyze the truss shown in the figure and find out forces in all bars. Use symmetry to reduce the number of equations you need to solve.



Problem 6.1.22