

6.3 Solving trusses on computers

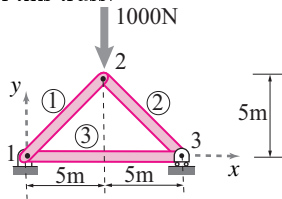
Preparatory Problems

You should check your mastery of the method of joints problems before working on this section.

6.3.1 Define these matrices and column vectors used to define a truss, the loading on it, the bar tensions, the reactions, and the coefficients in the matrix form of the joint equilibrium equations:

- $[J]$
- $[B]$
- $[R]$
- $[F]$
- $[T]$
- $[L]$
- $[A]$

6.3.2 By hand, with no use of a computer, find all of the matrices and column vectors above for this truss.



Problem 6.3.2

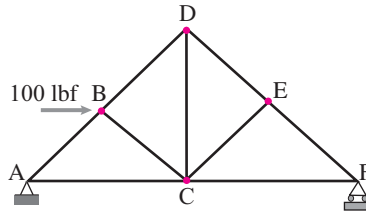
6.3.3 When does the numerical recipe presented here succeed and when does it fail? When it fails, how does it fail?

6.3.4

- Write a computer program, using your preferred language or package, that takes as input the matrices $[J]$, $[B]$, $[R]$, and $[F]$ and calculates $[T]$.
- Test this program on the truss of problem 6.3.2.

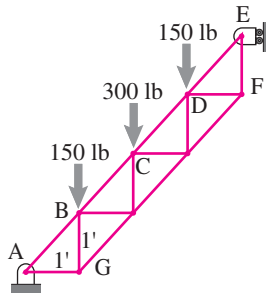
More-Involved Problems

6.3.5 All of the bars in the symmetric truss below are either level or at 30° from the horizontal. Find all the bar forces and reactions.



Problem 6.3.5

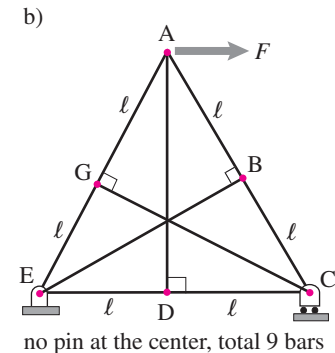
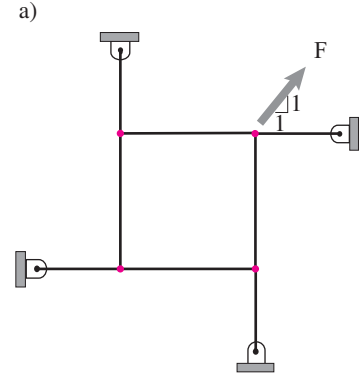
6.3.6 Find the force in each bar of the staircase truss shown in the figure by writing the required number of equilibrium equations and then solving them on a computer.



Problem 6.3.6

6.3.7 Find the tensions in all the bars, and all the reactions for these structures.

- A square supported by four bars. This is perhaps the simplest rigid structure that has no triangles.
- The 9-bar structure shown. This structure also has no triangles in that there is no closed circuit that involves only three bars (for example, from D to A to B to C and back to D involves 4 bars).



Problem 6.3.7

6.3.8 Analyze the truss given in Problem 6.1.20 and solve for all bar tensions and support reactions.

6.3.9 Solve Problem 6.1.21.

6.3.10 Solve Problem 6.1.22.

6.3.11 Using your program from problem 6.3.4 solve each of the following problems:

- Problem 6.1.10
- Problem 6.1.11
- Problem 6.1.13
- Problem 6.2.5
- Problem 6.2.7
- Problem 6.2.12