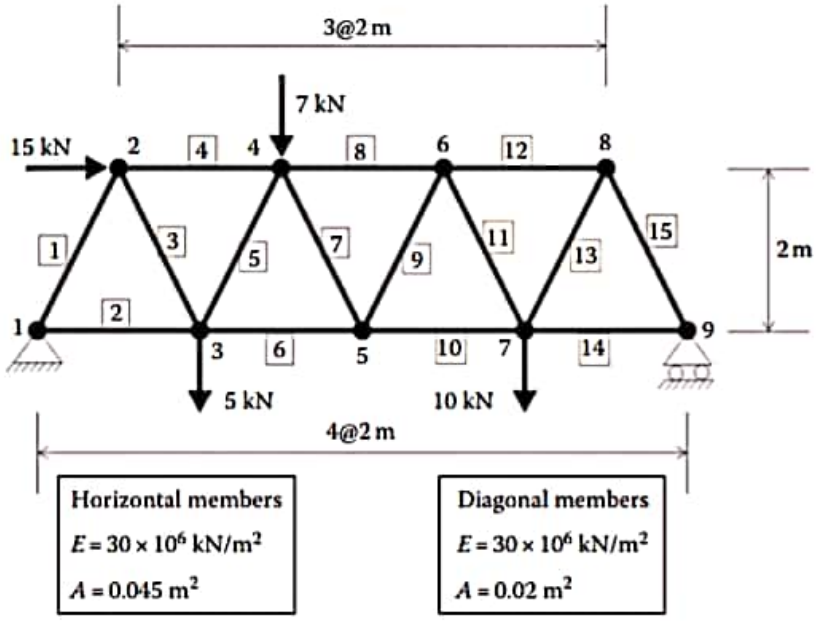

FIGURE 2.9 Model of Problem 2.1.

```
% to be used by all the functions (M-files) constituting
% the program
%
global nnd nel nne nodof eldof n global geom connec prop nf load
%
format short e
%
%%%%%%%%%%%%%%% Beginning of data input %%%%%%%%%%%%%%%%
%
nnd = 9; % Number of nodes:
nel = 15; % Number of elements:
nne = 2 ; % Number of nodes per element:
nodof =2 ; % Number of degrees of freedom per node
eldof = nne*nodof; % Number of degrees of freedom
                   % per element
%
% Nodes coordinates X and Y
geom=zeros(nnd,2);
geom = [0.      0.; ...   % X and Y coord. node 1
        1.      2.; ...   % X and Y coord. node 2
        2.      0.; ...   % X and Y coord. node 3
        3.      2.; ...   % X and Y coord. node 4
        4.      0.; ...   % X and Y coord. node 5
        5.      2.; ...   % X and Y coord. node 6
        6.      0.; ...   % X and Y coord. node 7
        7.      2.; ...   % X and Y coord. node 8
        8.      0.] ;     % X and Y coord. node 9

%
% Element connectivity
%
connec=zeros(nel,2);
connec = [1    2 ; ...    % 1st and 2nd node of element 1
          1    3 ; ...    % 1st and 2nd node of element 2
          2    3 ; ...    % 1st and 2nd node of element 3
          2    4 ; ...    % 1st and 2nd node of element 4
          3    4 ; ...    % 1st and 2nd node of element 5
          3    5 ; ...    % 1st and 2nd node of element 6
          4    5 ; ...    % 1st and 2nd node of element 7
          4    6 ; ...    % 1st and 2nd node of element 8
```

```
          5    6 ; ...    % 1st and 2nd node of element 9
          5    7 ; ...    % 1st and 2nd node of element 10
          6    7 ; ...    % 1st and 2nd node of element 11
          6    8 ; ...    % 1st and 2nd node of element 12
          7    8 ; ...    % 1st and 2nd node of element 13
          7    9 ; ...    % 1st and 2nd node of element 14
          8    9 ]  ;     % 1st and 2nd node of element 15
%
% Geometrical properties
%
% prop(1,1) = E; prop(1,2)= A
%
prop=zeros(nel,2);
prop  = [30.e6       0.02  ; ...   % E and A of element 1
         30.e6       0.045 ; ...   % E and A of element 2
         30.e6       0.02  ; ...   % E and A of element 3
         30.e6       0.045 ; ...   % E and A of element 4
         30.e6       0.02  ; ...   % E and A of element 5
         30.e6       0.045 ; ...   % E and A of element 6
         30.e6       0.02  ; ...   % E and A of element 7
         30.e6       0.045 ; ...   % E and A of element 8
         30.e6       0.02  ; ...   % E and A of element 9
         30.e6       0.045 ; ...   % E and A of element 10
         30.e6       0.02  ; ...   % E and A of element 11
         30.e6       0.045 ; ...   % E and A of element 12
         30.e6       0.02  ; ...   % E and A of element 13
         30.e6       0.045 ; ...   % E and A of element 14
         30.e6       0.02  ];     % E and A of element 15
%
% Boundary conditions
%
nf = ones(nnd, nodof); % Initialize the matrix nf to 1
nf(1,1) = 0; nf(1,2) =0 ; % Prescribed nodal freedom of node 1
nf(9,2)= 0 ;              % Prescribed nodal freedom of node 3
%
% Counting of the free degrees of freedom
%
n=0; for i=1:nnd
    for j=1:nodof
        if nf(i,j) ~= 0
        n=n+1;
        nf(i,j)=n;
        end
    end
end
%
% loading
%
load = zeros(nnd, 2);
load(2,:)=[15.   0.];  %forces in X and Y directions at node 2
load(3,:)=[0.   -5.];  %forces in X and Y directions at node 3
load(4,:)=[0.   -7.];  %forces in X and Y directions at node 4
load(7,:)=[0.   -10.]; %forces in X and Y directions at node 7

%
%%%%%%%%%%%%%%%%%%%%%%% End of input %%%%%%%%%%%%%%%%%%%%%%%
```

Results file

```
 ******* PRINTING MODEL DATA **************


-----------------------------------------------------
Number of nodes:                                    9
Number of elements:                                15
Number of nodes per element:                        2
```

```
Number of degrees of freedom per node:          2
Number of degrees of freedom per element:       4

-----------------------------------------------------
Node        X            Y
 1,      0000.00,      0000.00
 2,      0001.00,      0002.00
 3,      0002.00,      0000.00
 4,      0003.00,      0002.00
 5,      0004.00,      0000.00
 6,      0005.00,      0002.00
 7,      0006.00,      0000.00
 8,      0007.00,      0002.00
 9,      0008.00,      0000.00

-----------------------------------------------------
Element      Node_1      Node_2
    1,         1,          2
    2,         1,          3
    3,         2,          3
    4,         2,          4
    5,         3,          4
    6,         3,          5
    7,         4,          5
    8,         4,          6
    9,         5,          6
    10,         5,          7
    11,         6,          7
    12,         6,          8
    13,         7,          8
    14,         7,          9
    15,         8,          9

-----------------------------------------------------
Element        E             A
    1,       3e+007,       0.02
    2,       3e+007,       0.045
    3,       3e+007,       0.02
    4,       3e+007,       0.045
    5,       3e+007,       0.02
    6,       3e+007,       0.045
    7,       3e+007,       0.02
    8,       3e+007,       0.045
    9,       3e+007,       0.02
    10,       3e+007,       0.045
    11,       3e+007,       0.02
    12,       3e+007,       0.045
    13,       3e+007,       0.02
    14,       3e+007,       0.045
    15,       3e+007,       0.02

-----------------------------------------------------
Node      disp_U     disp_V
  1,        0,          0
  2,        1,          2
  3,        3,          4
  4,        5,          6
  5,        7,          8
  6,        9,          10
  7,        11,          12
  8,        13,          14
  9,        15,          0

-----------------------------------------------------
Node      load_X         load_Y
  1,      0000.00,        0000.00
  2,      0015.00,        0000.00
```

```
  3,      0000.00,        -005.00
  4,      0000.00,        -007.00
  5,      0000.00,        0000.00
  6,      0000.00,        0000.00
  7,      0000.00,        -010.00
  8,      0000.00,        0000.00
  9,      0000.00,        0000.00
-----------------------------------------------------

Total number of active degrees of freedom, n = 15

-----------------------------------------------------


 ******* PRINTING ANALYSIS RESULTS **************


-----------------------------------------------------
Global force vector  F
   15
   0
   0
   -5
   0
   -7
   0
   0
   0
   0
   0
   -10
   0
   0
   0

-----------------------------------------------------
Displacement solution vector:  delta
  0.00014
 -0.00010
  0.00003
 -0.00019
  0.00010
 -0.00023
  0.00006
 -0.00023
  0.00007
 -0.00021
  0.00009
 -0.00018
  0.00005
 -0.00009
  0.00010

-----------------------------------------------------
Nodal displacements
Node      disp_X        disp_Y
 1,      0.00000,       0.00000
 2,      0.00014,      -0.00010
 3,      0.00003,      -0.00019
 4,      0.00010,      -0.00023
 5,      0.00006,      -0.00023
 6,      0.00007,      -0.00021
 7,      0.00009,      -0.00018
 8,      0.00005,      -0.00009
 9,      0.00010,       0.00000

-----------------------------------------------------
```



```
Members actions
element      force         action
 1,           -7.69,       Compression
 2,           18.44,       Tension
 3,            7.69,       Tension
 4,          -21.87,       Compression
 5,           -2.10,       Compression
 6,           22.81,       Tension
 7,           -5.73,       Compression
 8,          -20.25,       Compression
 9,            5.73,       Tension
 10,           17.69,       Tension
 11,           -5.73,       Compression
 12,          -15.12,       Compression
 13,           16.91,       Tension
 14,            7.56,       Tension
 15,          -16.91,       Compression
```