Computer Implementation 1.11 *(Matlab)* *Complete solution of a plane truss (p. 51)*

By combining procedures discussed in earlier implementations, here we present a complete *Matlab* based solution for the five bar truss. This implementation can be used as template to analyze any other plane truss. The global matrices K and R are generated first using statements discussed earlier. To conserve space, printing of individual element matrices is suppressed by using semicolon at the end of each line.

MatlabFiles\Chap1\FiveBarTrussEx.m

```
% Five bar truss example
e1=200*10^3; e2=70*10^3; a1=40*100; a2=30*100; a3=20*100;
P = 150*10^3;
nodes = 1000*[0, 0; 1.5, 3.5; 0, 5; 5, 5];
conn = [1,2; 2,4; 1,3; 3,4; 2,3];
lmm = [1,2,3,4; 3, 4, 7, 8; 1, 2, 5, 6; 5, 6, 7, 8; 3, 4, 5, 6];
K=zeros(8);
% Generate stiffness matrix for each element and assemble it.
for i=1:2
    lm=lmm(i,:);
    con=conn(i,:);
    k=PlaneTrussElement(e1, a1, nodes(con,:));
    K(lm, lm) = K(lm, lm) + k
end
for i=3:4
    lm=lmm(i,:);
    con=conn(i,:);
    k=PlaneTrussElement(e1, a2, nodes(con,:));
    K(lm, lm) = K(lm, lm) + k
end

lm=lmm(5,:); con=conn(5,:);
k=PlaneTrussElement(e2, a3, nodes(con,:));
K(lm, lm) = K(lm, lm) + k

% Define the load vector
R = zeros(8,1); R(4)=-P

% Nodal solution and reactions
[d, reactions] = NodalSoln(K, R, [1,2,7,8], zeros(4,1))
results=[];
for i=1:2
    results = [results; PlaneTrussResults(e1, a1, ...
            nodes(conn(i,:),:), d(lmm(i,:)))];
end
for i=3:4
    results = [results; PlaneTrussResults(e1, a2, ...
            nodes(conn(i,:),:), d(lmm(i,:)))];
end
format short g
results = [results; PlaneTrussResults(e2, a3, ...
        nodes(conn(5,:),:), d(lmm(5,:)))]


>> FiveBarTrussEx

K =
```

```
  Columns 1 through 6

        32600          76067         -32600         -76067              0
0
        76067   2.9749e+005         -76067   -1.7749e+005              0
-1.2e+005
       -32600         -76067    2.4309e+005    1.1914e+005         -32998
32998
       -76067   -1.7749e+005    1.1914e+005    2.4309e+005          32998
-32998
            0              0         -32998          32998      1.53e+005
-32998
            0      -1.2e+005          32998         -32998         -32998
1.53e+005
            0              0   -1.7749e+005         -76067      -1.2e+005
0
            0              0         -76067         -32600              0
0

  Columns 7 through 8

            0              0
            0              0
 -1.7749e+005         -76067
      -76067         -32600
   -1.2e+005              0
            0              0
  2.9749e+005          76067
       76067          32600


R =

            0
            0
            0
      -150000
            0
            0
            0
            0


d =

            0
            0
      0.53895
     -0.95306
       0.2647
      -0.2647
            0
            0


reactions =

        54927
```

```
   1.5993e+005
        -54927
        -9926.7


results =

  -0.0001743       -34.859 -1.3944e+005
   -3.15e-005       -6.2999       -25200
 -5.2941e-005       -10.588       -31764
 -5.2941e-005       -10.588       -31764
   0.00032087        22.461        44922
```