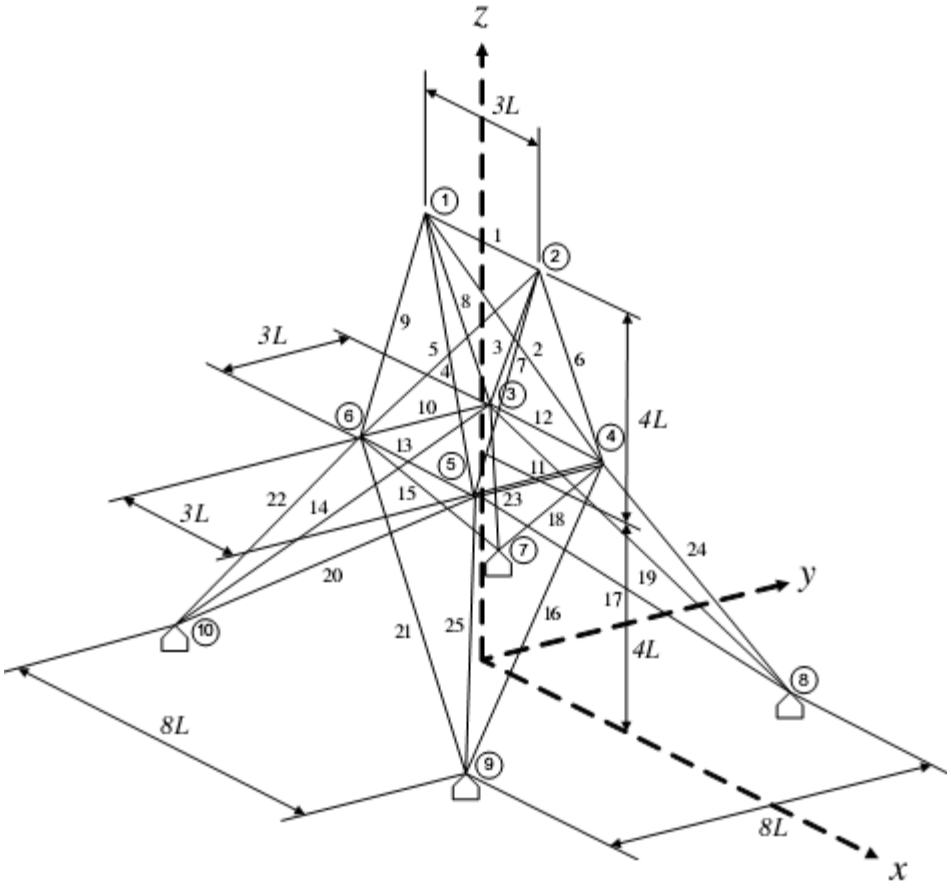
A twenty five-bar truss is considered as shown in the following figure:




25-bar truss example

Nodal loads for the 25-bar truss

| Node | $F_x$ | $F_y$ | $F_z$ |
|---|---|---|---|
| 1 | 1000 | −10,000 | −10,000 |
| 2 | 0 | −10,000 | −10,000 |
| 3 | 500 | 0 | 0 |
| 6 | 600 | 0 | 0 |

| Joint | $x$ (in) | $y$ (in) | $z$ (in) |
|---|---|---|---|
| 1 | −37.5 | 0.0 | 200.0 |
| 2 | 37.5 | 0.0 | 200.0 |
| 3 | −37.5 | 37.5 | 100.0 |
| 4 | 37.5 | 37.5 | 100.0 |
| 5 | 37.5 | −37.5 | 100.0 |
| 6 | −37.5 | −37.5 | 100.0 |
| 7 | −100.0 | 100.0 | 0.0 |
| 8 | 100.0 | 100.0 | 0.0 |
| 9 | 100.0 | −100.0 | 0.0 |
| 10 | −100.0 | −100.0 | 0.0 |

1. Definition of Data (Data.m)

```
function D=Data(YM)
%  Definition of Data

%  Nodal Coordinates
Coord=[-37.5 0 200;37.5 0 200;-37.5 37.5 100;37.5 37.5 100;37.5 -37.5…
100;-37.5 -37.5 100;-100 100 0;100 100 0;100 -100 0;-100 -100 0];

%  Connectivity
Con=[1 2;1 4;2 3;1 5;2 6;2 4;2 5;1 3;1 6;3 6;4 5;3 4;5 6;3 10;6 7;4 9;5 8;…
4 7;3 8;5 10;6 9;6 10;3 7;4 8;5 9];

% Definition of Degree of freedom (free=0 &  fixed=1)
% for 2-D trusses the last column is equal to 1
Re=zeros(size(Coord));
Re(7:10,:)=[1 1 1;1 1 1;1 1 1;1 1 1];
% or:   Re=[0 0 0;0 0 0;0 0 0;0 0 0;0 0 0;0 0 0;0 0 0;1 1 1;1 1 1;1 1 1;1 1 1];

% Definition of Nodal loads
Load=zeros(size(Coord));
Load([1:3,6],:)=1e3*[1 -10 -10;0 -10 -10;0.5 0 0;0.6 0 0];
% or:   Load=1e3*[1 -10 -10;0 -10 -10;0.5 0 0;0 0 0;0 0 0;0.6 0 0;…
%                       0 0 0;0 0 0;0 0 0;0 0 0];
```

```
% Definition of Modulus of Elasticity
E=ones(1,size(Con,1))*YM;
% or:   E=[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1]*1e7;

% Definition of Area
A=[.4 .1 .1 .1 .1 3.4 3.4 3.4 3.4 .4 .4 1.3 1.3 .9 .9 .9 .9 1 1 1 1 3.4 3.4…
 3.4 3.4];

% Convert to structure array
D=struct('Coord',Coord ','Con',Con ','Re',Re ','Load',Load ','E',E ','A',A ');
```

## 2. Analysis of Truss (ST.m) ; Forces(F) , Deflections(U) , Reactions(R)

Write in Command Line:

```
>> D=Data(1e7) ; [F,U,R]=ST(D)

F =

  1.0e+004 *

  Columns 1 through 10

   -0.0336   -0.0240    0.0629   -0.0915   -0.0044    0.8385   -1.9544    0.9097   -1.8832   -0.0257

  Columns 11 through 20

   -0.0295    0.2846   -0.6882    0.2270   -0.3768    0.2003   -0.4035    0.1887    0.1736   -0.4047

  Columns 21 through 25

   -0.4288   -1.7643    0.9059    0.7367   -1.9404


U =

    0.1131    0.1068   -0.0048    0.0117   -0.0156    0.0241         0         0         0         0
   -0.3489   -0.3479    0.0177    0.0172    0.0227    0.0225         0         0         0         0
   -0.0455   -0.0522    0.0615    0.0566   -0.1256   -0.1216         0         0         0         0


R =

  1.0e+004 *

         0         0         0         0         0         0   -0.4375    0.3375   -1.1651    1.0550
         0         0         0         0         0         0    0.2034    0.0986    0.9046    0.7935
         0         0         0         0         0         0   -0.5750   -0.4250    1.5800    1.4200
```

For example:
Force in the member 2-4 = Force(6) = 0.8385e4
Displacement of node 4 in y direction = 0.0172
Reaction of node 8 in z zirection = - 0.4250e4

Note: If the structure is unstable, this warning is appeared:
Warning: Matrix is singular to working precision.
Some of the Forces & Displacements are equal to NaN.

## 3. Plot Truss and Deformation shape (TP.m) (Optional)

Write in Command Line:
>> TP(D,U,20)
Note: The last argument is the scaling factor for deformation shape