

## Computer Implementation 1.7 (*Matlab*) bracket assembly (p. 36)

Use *Matlab* to develop element equations and assemble them to form global equations for the cantilever bracket.

MatlabFiles\Chap1\PlaneStressAssemblyEx.m

```
% Plane Stress Assembly Example
e = 10^4; nu = 0.2; h=0.25; q=-20;
nodes=[0,0; 0,2; 2,0; 2,3/2; 4,0; 4,1];
conn = [1,3,4; 4,2,1; 3,5,6; 6,4,3];
lmm = [1,2,5,6,7,8; 7,8,3,4,1,2;
       5,6,9,10,11,12; 11,12,7,8,5,6];

K=zeros(12); R = zeros(12,1);
% Generate equations for each element and assemble them.
for i=1:4
    con = conn(i,:);
    lm = lmm(i,:);
    k = PlaneStressTriElement(e, nu, h, nodes(con,:));
    K(lm, lm) = K(lm, lm) + k;
end
% Define the nodal load vector
con = conn(2,:);
lm = lmm(2,:);
rq = PlaneStressTriLoad(1,q,0,h,nodes(con,:));
R(lm) = R(lm) + rq;

con = conn(4,:);
lm = lmm(4,:);
rq = PlaneStressTriLoad(1,q,0,h,nodes(con,:));
R(lm) = R(lm) + rq;
K
R
```

The `PlaneStressTriElement` function defined in *Matlab* Implementation 1.3 is used to generate element matrices for all elements in the model. A normal pressure is applied to side 1 of elements 2 and 4. The pressure acts in the direction opposite to the outer normal to the surface and therefore it must be assigned a negative sign. For the other two elements the *r* vector is all zeros. From the node numbering shown in the figure, and with two degree of freedom per node, the assembly location vectors for all elements are defined. The assembly can now be carried out easily by using the for loop.

```
>> PlaneStressAssemblyEx
```

```
K =
```

```
1.0e+003 *
```

```
Columns 1 through 7
```

1.5788	0.1953	-0.2767	0.3255	-0.9766	0.2604	-0.3255
0.1953	1.7253	0.0651	-1.2044	0.5208	-0.3906	-0.7813
-0.2767	0.0651	1.2533	-0.5859	0	0	-0.9766
0.3255	-1.2044	-0.5859	1.5951	0	0	0.2604
-0.9766	0.5208	0	0	3.1250	-0.5208	-1.1719
0.2604	-0.3906	0	0	-0.5208	4.1667	0.5208
-0.3255	-0.7813	-0.9766	0.2604	-1.1719	0.5208	3.1250
-0.7813	-0.1302	0.5208	-0.3906	0.5208	-3.3854	-0.5208
0	0	0	0	-0.6510	0.5208	0

0	0	0	0	0.2604	-0.2604	0
0	0	0	0	-0.3255	-0.7813	-0.6510
0	0	0	0	-0.7813	-0.1302	0.5208

Columns 8 through 12

-0.7813	0	0	0	0
-0.1302	0	0	0	0
0.5208	0	0	0	0
-0.3906	0	0	0	0
0.5208	-0.6510	0.2604	-0.3255	-0.7813
-3.3854	0.5208	-0.2604	-0.7813	-0.1302
-0.5208	0	0	-0.6510	0.5208
4.1667	0	0	0.2604	-0.2604
0	1.6927	-0.7813	-1.0417	0.2604
0	-0.7813	2.8646	0.5208	-2.6042
0.2604	-1.0417	0.5208	2.0182	0
-0.2604	0.2604	-2.6042	0	2.9948

R =

0
0
-1.2500
-5.0000
0
0
-2.5000
-10.0000
0
0
-1.2500
-5.0000

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