Computer Implementation 1.6 *(Matlab)* *square duct assembly (p. 32)*

MatlabFiles\Chap1\HeatAssemblyEx.m

```
% Heat Assembly Example
kx=1.4; ky=1.4; Q=0;
nodes=[0,0; 20,0; 20,30; 0,10; 10,10]/100;
lmm =[1,2,5; 2,3,5; 3,4,5; 1,5,4];

K=zeros(5); R = zeros(5,1);
% Generate equations for each element and assemble them.
for i=1:4
    lm = lmm(i,:);
    [k, r] = HeatTriElement(kx, ky, Q, nodes(lm,:));
    K(lm, lm) = K(lm, lm) + k;
    R(lm) = R(lm) + r;
end
% Add the term beacuse of convection on side 1 of element 2
h=27;Tinf=20; lm = lmm(2,:);
[kh, rh] = ConvectionTerm(1,h,Tinf,nodes(lm,:));
K(lm, lm) = K(lm, lm) + kh
R(lm) = R(lm) + rh
```

From the node numbering shown in the figure the assembly location vectors for all elements are defined. The HeatTriElement function defined in an earlier *Matlab* Implementation is first used to generate element matrices for all elements in the model. Since all elements have the same thermal properties, and the elements nodes are same as the lm vectors established already, it is convenient to use for loop to compute element $\boldsymbol{k}_k$ and $\boldsymbol{r}_Q$. The element 2 has convection condition on side 1 with $h = 27$ and $T_\infty = 20$. Thus we must add $\boldsymbol{k}_h$ and $\boldsymbol{r}_h$ terms to the second element equations.

```
>> HeatAssemblyEx

K =

    1.4000         0         0   -0.7000   -0.7000
         0    4.5667    1.5833         0   -2.1000
         0    1.5833    3.5167    0.3500   -1.4000
   -0.7000         0    0.3500    3.1500   -2.8000
   -0.7000   -2.1000   -1.4000   -2.8000    7.0000


R =

     0
    81
    81
     0
     0
```