Computer Implementation 3.1 ***(Matlab)*** *Heat flow through fins (p. 198)*

The tedious calculations to solve the previous heat flow problem can be conveniently carried out using *Matlab* functions presented earlier. Using these functions, and following procedures discussed in Chapter 1, the global equations for the four quadratic element model can be developed and assembled as follows.

MatlabFiles\Chap3\FinHeatFlowEx.m

```
% Heat flow through a fin
kx=237;w=3;t=0.3/100;A=w*t;h=30;L=20/100.;P=2*(w+t);Tinf=25;
alpha=-h*A/(kx*A); beta=h*A*Tinf/(kx*A);
k=kx*A; p=-h*P; q=h*P*Tinf;
nodes = [0:L/8:L];n=length(nodes);
K=zeros(n); R = zeros(n,1);
% Generate equations for each element and assemble them.
for i=1:4
   lm=[2*(i-1)+1,2*(i-1)+2,2*(i-1)+3];
   [ke, re] = BVP1DQuadElement(k,p,q, nodes(lm));
   K(lm, lm) = K(lm, lm) + ke;
   R(lm) = R(lm) + re;
end
% Adjust for NBC
K(n,n)=K(n,n)-alpha*k
R(n)=R(n)+beta*k
% Nodal solution and reactions
d = NodalSoln(K, R, [1], [100])
plot(nodes,d),title('Temperature distribution'), xlabel('x'),ylabel('T')
```

```
>> FinHeatFlowEx

K =

  Columns 1 through 7

  100.7412 -113.1594   13.9197         0         0         0         0
 -113.1594  232.3248 -113.1594         0         0         0         0
   13.9197 -113.1594  201.4824 -113.1594   13.9197         0         0
         0         0 -113.1594  232.3248 -113.1594         0         0
         0         0   13.9197 -113.1594  201.4824 -113.1594   13.9197
         0         0         0         0 -113.1594  232.3248 -113.1594
         0         0         0         0   13.9197 -113.1594  201.4824
         0         0         0         0         0         0 -113.1594
         0         0         0         0         0         0   13.9197

  Columns 8 through 9
```

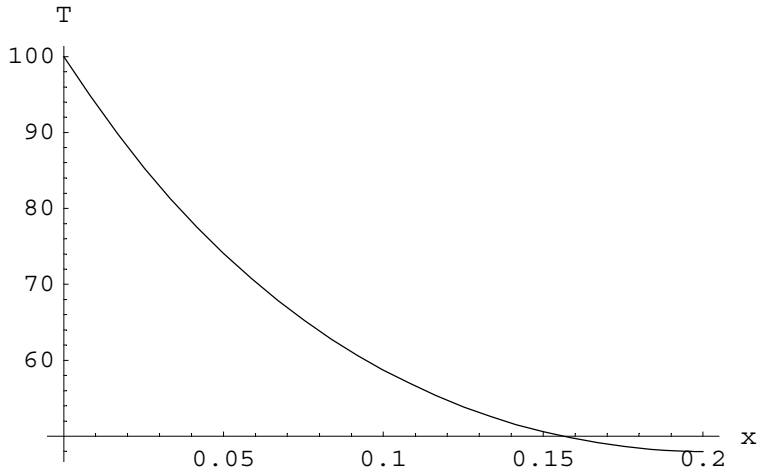
```
         0         0
         0         0
         0         0
         0         0
         0         0
         0         0
  -113.1594   13.9197
   232.3248 -113.1594
  -113.1594  101.0112
```

R =

```
   37.5375
  150.1500
   75.0750
  150.1500
   75.0750
  150.1500
   75.0750
  150.1500
   44.2875
```

d =

```
  100.0000
   85.4383
   74.0844
   65.3306
   58.7175
   53.8905
   50.5968
   48.6592
   47.9772
```


T
100
90
80
70
60
0.05
0.1
0.15
0.2
x