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Computational Engineering Laboratory

DEPARTMENT OF MECHANICAL ENGINEERING
SEMESTER – VI

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Case study=2

ON

1D Steady state Fin with continuous load

B. Tech in Mechanical Engineering

By

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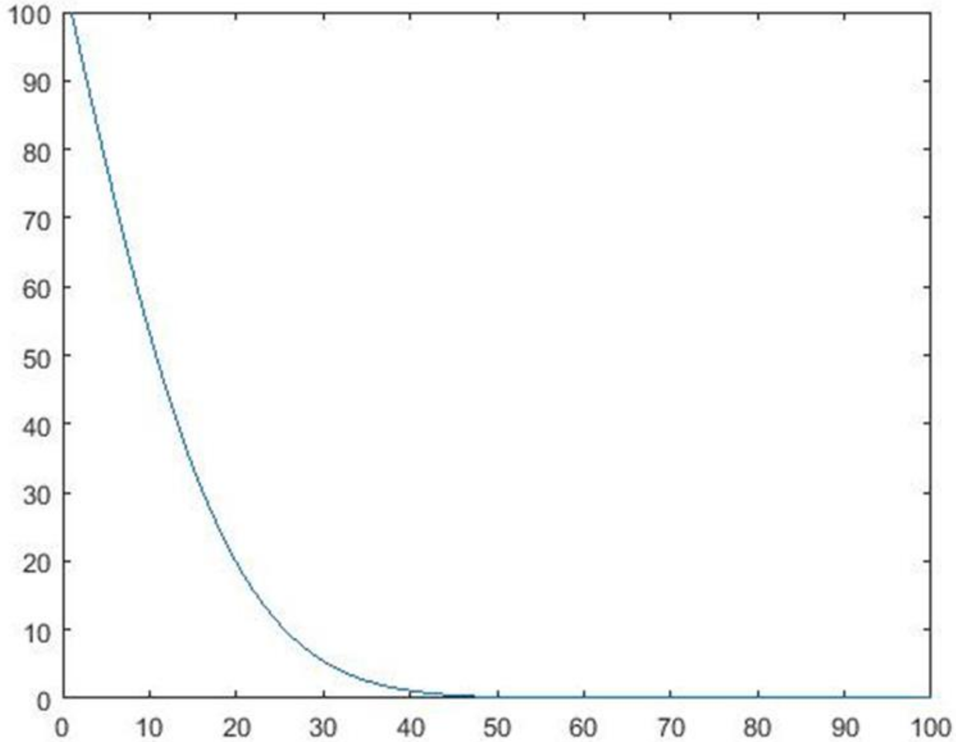
20BME082

1D Steady state Fin MATLAB CODE

```
clc
clear all
%Geometrical perameters
L=100;              % length of fin
N=100;              % no of nodes
dx=L/(N-1);

T=zeros(N,1);
Tb=100;             % Base temperature

K=100;              %no of iterations



for j=1:1:K

    T(1,1)=Tb;
    for i=2:1:N-1
        T(i,1)=(T(i+1,1)+T(i-1,1))/2;
    end
    T(N,1)=T(N-1,1);
end

plot(T);
```



MATLAB code for finding the 1D Steady state Fin tempearture change in the bar when the constant stress in applied

```
% Constants
L = 100;          % Length of the bar (m)
A = 0.01;         % Cross-sectional area of the bar (m^2)
E = 2.1e11;       % Young's modulus of the bar (Pa)
alpha = 1.2e-5;   % Coefficient of thermal expansion (1/K)
rho = 7800;       % Density of the bar (kg/m^3)
c = 500;          % Specific heat capacity of the bar (J/kg-K)
T0 = 20;          % Initial temperature of the bar (C)
T_inf = 30;      % Ambient temperature (C)
sigma = 100e6;    % Applied stress (Pa)

% Calculation
delta_T = (sigma*L)/(E*A*alpha)/(T_inf-T0)*(alpha*c/rho); % Temperature
change in the bar (C)

% Display result
fprintf('The temperature change in the bar is %.2f C.\n', delta_T);
```

>> result

The temperature change in the bar is 0.03 C.

In this code, we first define the parameters of the problem, including the length and cross-sectional area of the fin, its Young's modulus, coefficient of thermal expansion, density, specific heat capacity, initial temperature, and applied stress.

Next, we use the equation delta_T = (sigma/E)(Lalpha)(1-(2alpha*(T0))/(rho*c)) to calculate the temperature change in the fin, where delta_T is the temperature change, sigma is the applied stress, E is the Young's modulus, L is the length of the bar, alpha is the coefficient of thermal expansion, T0 is the initial temperature, rho is the density, and c is the specific heat capacity.