clc;

%% Inputs

g = 9.81;

E = input('Enter youngs modulus in N/mm^2 (constant)');

D = input('Enter density in kg/m^3 (constant)');

D = D \* 10^-9;

A = input('Enter Area of bar elements in mm^2(constant) ');

%% length inputs

m = input('Number of elements ');

L = zeros(m,1);

for i=1:m

fprintf('Enter length of element %d in mm ',i);

L(i,1)= input('');

end

%% global stiffness matrix

KGlobal=zeros(m+1,m+1);

for i = 1:m

KLocal = ((A\*E)/L(i,1)).\*[1 -1;-1 1];

KGlobal(i,i) = KGlobal(i,i)+KLocal(1,1);

KGlobal(i,i+1) = KGlobal(i,i+1)+KLocal(1,2);

KGlobal(i+1,i) = KGlobal(i+1,i)+KLocal(2,1);

KGlobal(i+1,i+1) = KGlobal(i+1,i+1)+KLocal(2,2);

end

disp('Global stifness matrix, G = ');

disp(KGlobal);

%% Force matrix

FGlobal = zeros(m+1,1);

f = zeros(m+1,1);

for i = 1:m+1

fprintf('Enter Force at node (%d) in N ',i);

f(i,1) = input('');

end

for i = 1:m

FLocal = (D\*g\*0.5\*A\*L(i,1)).\*[1;1];

FGlobal(i,1)= FGlobal(i,1)+ FLocal(1,1);

FGlobal(i+1,1) = FGlobal(i+1,1) + FLocal(2,1);

end

FGlobal = -1.\*FGlobal + f;

disp('Global Force matrix, F = ');

disp(FGlobal);

%% Displacements matrix

count = 0;

fprintf('Enter boundary conditions for nodal displacements:');

u = ones(m+1,1);

fprintf('\nWhich nodes are fixed? input row array ');

x = input('')';

xL = length(x);

%validity check

prompt1 = ('Unexpected no. of boundary conditions... please rerun code section ');

prompt2 = ('Unexpected boundary condition.. resuming anyway...');

if xL>=m+1

disp(prompt1);

return;

end

for j=1:xL

if x(j)<=m+1

u(x(j)) = 0;

else

if count==0;

u(1)=0;

disp(prompt2);

break;;

else

disp(prompt2);

continue;

end

end

count = count+1;

end

for i=1:m+1

if u(i)==0

KGlobal(i,1:m+1) = 0;

KGlobal(1:m+1,i) = 0;

FGlobal(i,1) = 0;

end

end

fprintf('\nAfter applying boundary conditions\n');

fprintf('K = \n');

disp(KGlobal);

fprintf('F = \n');

disp(FGlobal);

X = pinv(KGlobal)\*FGlobal;

for i=1:m+1

fprintf('U%d = %.3fmm\n',i,X(i));

end