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% Input File: Two Trianglular Elements Under Axial Load
%
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%
% This input file should be run prior to executing the FEA_Program routine.
%
% Format of required input:
%
%   numnp:           = number of nodes in the mesh (length(NodeTable))
%
%   numel:           = number of elements in the mesh
%
%   nen:             = maximum number of nodes per element (4)
%
%   PSPS:            = flag for plane stress ('s') or plane strain ('n')
%
%   NodeTable:       = table of mesh nodal coordinates defining the
%                     geometry of the mesh; format of the table is as
%                     follows:
%
%                     Nodes |           x-coord  y-coord
%                     n1   |   NodeTable = [x1    y1
%                     n2   |                   x2    y2
%                     ...   |                   ..    ..
%                     nnumnp |                   xnumnp ynumnp];
%
%   ix:              = table of mesh connectivity information, specifying
%                     how nodes are attached to elements and how materials
%                     are assigned to elements; entries in the first nen
%                     columns correspond to the rows of NodeTable
%                     representing the nodes attached to element e;
%                     entries in the last nen+1 column are rows from MateT
%                     signifying the material properties assigned to
%                     element e; format of the table is as follows:
%
%                     Elements |      n1    n2    n3    n4    mat
%                     e1      |   ix = [eln1  eln2  eln3  eln4  elmat
%                     e2      |           e2n1  e2n2  e2n3  e2n4  e2mat
%                     ...      |           ..    ..    ..    ..    ..
%                     numel    |           values for element numel  ];
%
%   MateT:           = table of mesh material properties for each distinct
%                     set of material properties; these sets are
%                     referenced by element e by setting the value of
%                     ix(e,nen+1) to the row number of the desired
%                     material set; format of the table is as follows:
%
%                     Materials |      E    v    t
%                     mat1     |   MateT = [E1  v1  t1
%                     mat2     |           E2  v2  t2
%                     ...       |           ..  ..  ..];
%
%   BCLIndex:        = list of the number of boundary conditions and loads
%                     applied to the mesh; first entry is the number of
%                     prescribed displacements at nodes; second entry is

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MateT = [mu1 mu2 kappa thick]; PSPS = 'nl';

% Body Force:
Fb = zeros(2,1);

% Time-Integration Parameters :
alpha = 0; gamma = (1-2*alpha)/2; beta = (1-alpha)^2/4; delt = 0.001;
del_t = delt; maxiter = 50; tmax=10; tSteps = tmax/delt + 1;

% Mesh Nodal Coordinates
NodeTable = [0      0
              L      0
              L      H
              0      H];

numnp = length(NodeTable);

% Mesh Element Connectivities
ix = [1  2  3  4  1];

nen = 4;
numel = 1;

% Mesh Boundary Conditions and Loads
BCLIndex = [4 2]';
NodeBC = [1  1  0
           1  2  0
           2  1  0
           2  2  0];

NodeLoad = [3  2  0
             4  2  0];

LoadDist=[0;0]; % Distribution of the Load on the two points.
tol=10^-12;      %tolerance used in N-R Method
                %increments in which external load are applied

% Magnitude of the Initial Applied Quasi-Static Displacement :
d1 = 0.2;
d2 = 0;
d3 = 0.2;
d4 = 0;

% Magnitude of the Initial Applied Velocity :

v1 = 0;
v2 = 0;
v3 = 0;
v4 = 0;

% Magnitude of the Initial Displacement :
do = [d1 d2 d3 d4]';
vo = [v1 v2 v3 v4]';

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% % Mass Matrix remains constant :
% ElemM = 0.25* [0.44667 0 0.22333 0 0.11222 0 0.22444 0
%               0 0.44667 0 0.22333 0 0.11222 0 0.22444
%               0 0 0.44667 0 0.22444 0 0.11222 0
%               0 0 0 0.44667 0 0.22444 0 0.11222
%               0 0 0 0 0.45111 0 0.22555 0
%               0 0 0 0 0 0.45111 0 0.22555
%               0 0 0 0 0 0 0.45111 0
%               0 0 0 0 0 0 0 0.45111];
%
%
% ElemM = ElemM + ElemM';
%
% for im = 1:length(diag(ElemM))
%     ElemM(im,im) = ElemM(im,im)/2;
% end
%
% % Pre-assigning Mdd to enhance the Speed :
% Mdd = ElemM(5:8,5:8);
%
% clc

iel = 1;
ndf = 2;
ndm = 2;
nieq = 0;

isw = 3;

% Interpret Boundary Conditions and assign Loads; allocate DOFS
assign_bc_load_data
nneq = neq + nieq;

% Initialization of the Newton Step:
n = 1; storej=1;

dn(:,n) = zeros(neq,1);
vn(:,n) = zeros(neq,1);
an(:,n) = zeros(neq,1);

% Last converged displacements for the first Newton step :
dn(:,1) = do;
vn(:,1) = vo;

% First iteration displacement for the first step : (Same as above)
dis(:,storej) = dn;
vel(:,storej) = vn;

% Definition of the External Force Vector :
time=linspace(0,tmax,tSteps);

FEA_Program

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