
```

% Code developed by Mrunmayi Mungekar and Devasmit Dutta
% MD_validate_elk_gamma validates the results from the two functions
MD_estiff and MD_etran
% Functions Called
%
%         none
%
% Dictionary of Variables
%   A = cross-sectional area
%   Izz = moment of inertia about local z-axis
%   Iyy = moment of inertia about local y-axis
%   J = torsional constant
%   Ayy = shear area along local y-axis
%   Azz = shear area along local z-axis
%   v = Poisson's ratio
%   L = length of element
%   E = Young's modulus
%   coordi = coordinates of 1st-node
%   coordj = coordinates of 2nd-node
%   webdir = element's unit web vector
%   gamma = local-to-global transformation matrix
%   elk = element stiffness matrix
%   globalk = global stiffness matrix
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Define material and geometric variables

A = 10;
Izz = 100;
Iyy = 20;
J = 1;
Ayy = 8;
Azz = 2;
v = 0.3;
L = 120*sqrt(2);
E = 29e3;

% Print element stiffness matrix

elk = MD_estiff (A, Izz, Iyy, J, Ayy, Azz, E, v, L);
disp('Element Stiffness Matrix')
disp(elk)

coordi = [0;0;0];
coordj = [120;120;0];
webdir = [-1/sqrt(2); 1/sqrt(2); 0];

% Print element transformation matrix

gamma = MD_etran(coordi, coordj, webdir);
disp('Element Transformation Matrix')

```

```
disp(gamma)
```

```
% Print global transformation matrix
```

```
globalk = gamma'*elk*gamma;  
disp('Global Stiffness Matrix')  
disp(globalk)
```

```
Element Stiffness Matrix
```

```
1.0e+04 *
```

```
Columns 1 through 7
```

0.1709	0	0	0	0	0	-0.1709
0	0.0007	0	0	0	0.0596	0
0	0	0.0001	0	-0.0120	0	0
0	0	0	0.0066	0	0	0
0	0	-0.0120	0	1.3561	0	0
0	0.0596	0	0	0	6.7669	0
-0.1709	0	0	0	0	0	0.1709
0	-0.0007	0	0	0	-0.0596	0
0	0	-0.0001	0	-0.0120	0	0
0	0	0	-0.0066	0	0	0
0	0	-0.0120	0	0.6725	0	0
0	0.0596	0	0	0	3.3492	0

```
Columns 8 through 12
```

0	0	0	0	0
-0.0007	0	0	0	0.0596
0	-0.0001	0	-0.0120	0
0	0	-0.0066	0	0
0	-0.0120	0	0.6725	0
-0.0596	0	0	0	3.3492
0	0	0	0	0
0.0007	0	0	0	-0.0596
0	0.0001	0	-0.0120	0
0	0	0.0066	0	0
0	-0.0120	0	1.3561	0
-0.0596	0	0	0	6.7669

```
Element Transformation Matrix
```

```
Columns 1 through 7
```

0.7071	0.7071	0.0000	0	0	0	0
-0.7071	0.7071	0.0000	0	0	0	0
0	-0.0000	1.0000	0	0	0	0
0	0	0	0.7071	0.7071	0.0000	0
0	0	0	-0.7071	0.7071	0.0000	0
0	0	0	0	-0.0000	1.0000	0
0	0	0	0	0	0	0.7071
0	0	0	0	0	0	-0.7071
0	0	0	0	0	0	0
0	0	0	0	0	0	0

0	0	0	0	0	0	0
0	0	0	0	0	0	0

Columns 8 through 12

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.7071	0.0000	0	0	0
0.7071	0.0000	0	0	0
-0.0000	1.0000	0	0	0
0	0	0.7071	0.7071	0.0000
0	0	-0.7071	0.7071	0.0000
0	0	0	-0.0000	1.0000

Global Stiffness Matrix
1.0e+04 *

Columns 1 through 7

0.0858	0.0851	0.0000	0	0.0000	-0.0422	-0.0858
0.0851	0.0858	0.0000	-0.0000	-0.0000	0.0422	-0.0851
0.0000	0.0000	0.0001	0.0085	-0.0085	0.0000	-0.0000
0	-0.0000	0.0085	0.6813	-0.6748	-0.0000	0
0.0000	-0.0000	-0.0085	-0.6748	0.6813	-0.0000	-0.0000
-0.0422	0.0422	0.0000	-0.0000	-0.0000	6.7669	0.0422
-0.0858	-0.0851	-0.0000	0	-0.0000	0.0422	0.0858
-0.0851	-0.0858	-0.0000	-0.0000	0.0000	-0.0422	0.0851
-0.0000	-0.0000	-0.0001	0.0085	-0.0085	-0.0000	0.0000
0	-0.0000	0.0085	0.3330	-0.3396	-0.0000	0
0.0000	-0.0000	-0.0085	-0.3396	0.3330	-0.0000	-0.0000
-0.0422	0.0422	0.0000	-0.0000	-0.0000	3.3492	0.0422

Columns 8 through 12

-0.0851	-0.0000	0	0.0000	-0.0422
-0.0858	-0.0000	-0.0000	-0.0000	0.0422
-0.0000	-0.0001	0.0085	-0.0085	0.0000
-0.0000	0.0085	0.3330	-0.3396	-0.0000
0.0000	-0.0085	-0.3396	0.3330	-0.0000
-0.0422	-0.0000	-0.0000	-0.0000	3.3492
0.0851	0.0000	0	-0.0000	0.0422
0.0858	0.0000	-0.0000	0.0000	-0.0422
0.0000	0.0001	0.0085	-0.0085	-0.0000
-0.0000	0.0085	0.6813	-0.6748	-0.0000
0.0000	-0.0085	-0.6748	0.6813	-0.0000
-0.0422	-0.0000	-0.0000	-0.0000	6.7669