Laboratory 8

<table>
<thead>
<tr>
<th>Function</th>
<th>Variable Passed In</th>
<th>Size</th>
<th>Variable Passed Out</th>
<th>Size</th>
<th>Functions Called</th>
</tr>
</thead>
<tbody>
<tr>
<td>ud_elfem.m</td>
<td>L</td>
<td>1 by 1</td>
<td>FEML</td>
<td>1 by 12</td>
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<tr>
<td></td>
<td>w</td>
<td>1 by 3</td>
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<tr>
<td>ud_femfemg.m</td>
<td>L</td>
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<td>FEMG</td>
<td>1 by 12</td>
<td>ud_elfem.m</td>
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<td></td>
<td>del</td>
<td>1 by 3</td>
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<td>ud_trans.m</td>
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<td></td>
<td>webdir</td>
<td>1 by 3</td>
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<td>w</td>
<td>1 by 3</td>
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<td>ud_femffems.m</td>
<td>nele</td>
<td>1 by 1</td>
<td>FEMF</td>
<td>NFDOF by 1</td>
<td>ud_femfemg.m</td>
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<td>ends</td>
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<td>FEMS</td>
<td>NSDOF by 1</td>
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<td>coord</td>
<td>nnodes by 3</td>
<td>FEMG</td>
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<td>nnodes by 6</td>
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<td>nsdof</td>
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</table>
function `FEML = ud_elfem(L,w)`

**Function purpose:**
This function generates the element fixed end moments in the element's local coordinate system based on uniformly distributed loads.

**Functions Called**
< none >

**Dictionary of Variables**
**Input Information:**

- `L` == length of element
  
  **NOTE:** It is better to use "L" rather than "l" to avoid typo mistakes (e.g. typing l rather 1).  
- `w(1)` == wx, uniform load along x-axis of element  
- `w(2)` == wy, uniform load along y-axis of element  
- `w(3)` == wz, uniform load along z-axis of element

**Output information:**

- `FEML(12)` == element fixed end moments (row)
  - `FEML(1)` == x-force at start node  
  - `FEML(2)` == y-force at start node  
  - `FEML(3)` == z-force at start node  
  - `FEML(4)` == x-moment at start node  
  - `FEML(5)` == y-moment at start node  
  - `FEML(6)` == z-moment at start node  
  - `FEML(7)` == x-force at end node  
  - `FEML(8)` == y-force at end node  
  - `FEML(9)` == z-force at end node  
  - `FEML(10)` == x-moment at end node  
  - `FEML(11)` == y-moment at end node  
  - `FEML(12)` == z-moment at end node

**Local Information (suggested):**

- `ele` == element # being investigated  
- `L` == length of element  
  
  **NOTE:** It is better to use "L" rather than "l" to avoid typo mistakes (e.g. typing l rather 1).  
- `del(3)` == difference in element ele's x,y,z coordinates  
- `dof` == DOF # being investigated  
- `row` == variable used for loop index  
- `ivar(i)` == global DOF # corresponding to local DOF i of element being investigated  
- `arow` == variable used for array index

**Output information:**

- `FEMP(NFDOF)` == Free part of global fixed end moment vector  
- `FEM(S(NFDOF)` == Supported part of global fixed end moment vector  
- of the global stiffness matrix  
- `FEMG(ele,12)` == element ele's fixed end moments in global coordinate space

**NOTE:**
Using the local and global DOF #’s, insert the element's fixed end force values into the correct locations in (FEMP) and (FEMG). The procedure is the following:
- -> check whether current DOF is Free (F) or Support (S)
- -> if free, put element's corresponding fem into (FEMP)
- -> otherwise, put fem entry into [FEMG]
- It is important to notice that we must add the current element's fem to any fem's already present in either (FEMP) or (FEMG).

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function `FEMP = ud_femfem(L,del,webdir,w,...
 norder,nfdo,nsdof)`

**Function purpose:**
This function determines the global fixed end moments with reference to the global coordinate space.

**Functions Called**
- `FEMP=ud_elfem(L,w)`
  
  determines the local fixed end moments for a given element
- `T=ud_trans(del,webdir)`
  
  determines the transformation matrix for a given element

**Dictionary of Variables**
**Input Information:**

- `ele` == total number of elements  
- `ele(1)` == element ele's start and end nodes  
  
  **coord(i,1,3)** == node i’s x,y,z coordinates  
  
  **webdir** == element ele's web unit vector  
  
  **w(ele,1,3)** == element ele’s wx,wy,wz uniform loads  
  
  **nfdo** == actual number of Free DOFs  
  
  **nsdo** == actual number of Support DOFs  
  
  **norder(i,6)** == free and supported DOF #’s corresponding to node i’s 5 DOFs.

  **NOTE:** norder will be positive if the DOF of the node is 'free' and norder will be negative if the DOF of the node is 'support'.

**Local Information:**

- `T(12,12)` == element’s transformation matrix (row,col)  
- `felm(12)` == element’s fixed end moments in local space

**Output information:**

- `FEMP(12)` == element fixed end moments (generalized forces) referencing global coordinate space

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