

MECH 151  
Commonly used scalars and arrays in MATLAB  
Static structural problems

**nodes** Node coordinates

- Rows: one for each node
- Column 1: x coordinate
- Column 2: y coordinate
- Column 3: z coordinate (3-D problems only)
- Source: entered manually or computed with `mesh2d`

**nnodes** Number of nodes: `nnodes=size(nodes,1);`

**ndof** Number of global DOF. Depends on element type

- truss2: `ndof = 2*nnodes`
- truss3: `ndof = 3*nnodes`
- beam2: `ndof = 3*nnodes`
- beam3: `ndof = 6*nnodes`
- tria: `ndof = 2*nnodes`

**elems** Specification of element connections

- Rows: one for each element
- Columns: elements with two nodes have two columns of node numbers, those with three nodes have three columns of node numbers.
- Optional additional columns may be used for element properties or loads applied to elements. item Source: entered manually or computed with `mesh2d`.

**nelems** Number of elements: `nelems=size(elems,1);`

**bc** Specification of constrained (supported) DOF

- Rows: one for each constrained DOF
- Column 1: node number
- Column 2: depends on element type.
  - \* `truss2` 1,2 for  $d_x, d_y$
  - \* `truss3` 1,2,3 for  $d_x, d_y, d_z$
  - \* `beam2` 1,2,3 for  $d_x, d_y, \phi_z$
  - \* `beam3` 1-6 for  $d_x, d_y, d_z, \phi_x, \phi_y, \phi_z$
  - \* `tria` 1,2 for  $u_x, u_y$
- Source: entered manually.

- Stability requirement: at least 3-6 entries depending on element type

**dof** DOF list

- Global index numbers for degrees of freedom at the nodes of a particular element
- `truss2` dof = [2\*n1-1 2\*n1 2\*n2-1 2\*n2]
- `truss3` dof = [3\*n1-2 3\*n1-2 3\*n1 3\*n2-2 3\*n2-1 3\*n2]
- `beam2` 1,2,3 dof = [3\*n1-2 3\*n1-2 2\*n1 3\*n2-2 3\*n2-1 3\*n2]
- `beam3` 1-6 dof = [6\*n1-5 6\*n1-4 6\*n1-3 6\*n1-2 6\*n1-1 6\*n1  
6\*n2-5 (etc) ]
- `tria` dof = [2\*n1-1 2\*n1 2\*n2-1 2\*n2]

**bigk** Global stiffness matrix

- Square matrix `ndof`×`ndof`
- Assembled in assembly loop.

**loads** Applied loads at nodes

- Rows: one for each global DOF that has an applied load
- Column 1: node number
- Column 2: index depending on element type. See above.
- Column 3: load magnitude

**bigp** Global load vector

- Rows: one for each DOF. See “DOF numbering” writeup.
- Computed from `loads` array.

**bigd** Global displacement vector

- Rows: one for each DOF. See “DOF numbering” writeup.
- Computed as `bigd(freedof) = bigk(freedof,freedof)\bigp(freedof)`

**bigf** Global reaction vector

- At restrained DOF, the reaction force; at unrestrained DOF, the applied load, if any
- Rows: one for each DOF
- Calculated as `bigf = bigk*bigd`