ELEMENT SELECTION

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Chapter 3

- There are several types of structural and non structural elements in LS-DYNA
- The structural elements consists of:
  - Beam
  - Shell
  - Tshell
  - Soild
- There exists other elements in LS-DYNA such as discrete, concentrate mass, seatbelt, etc.
- Each element needs *SECTION in which different formulations and other parameters are defined

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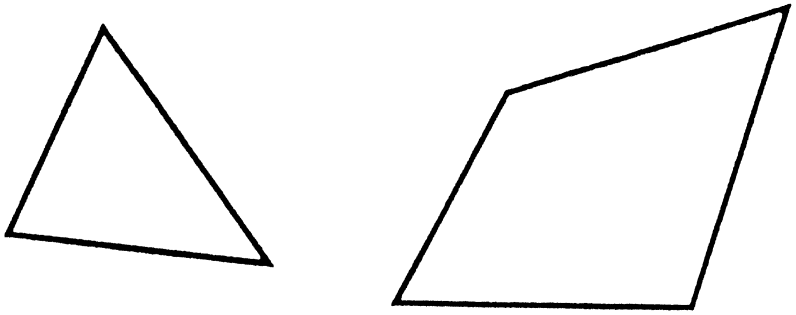
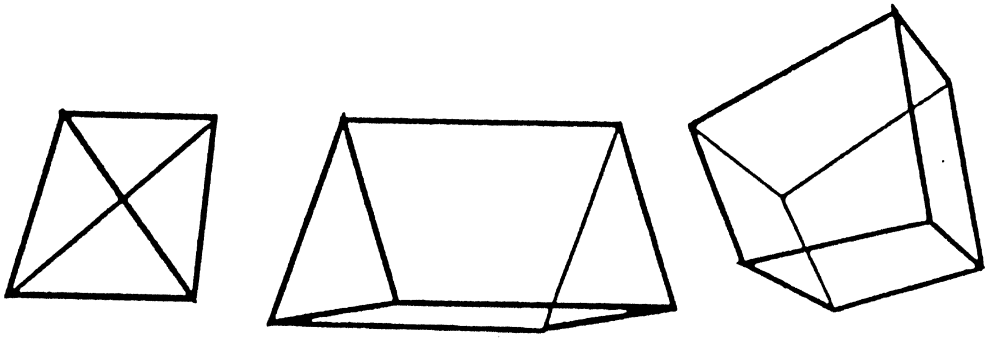
Shells



Solids



Beams/Trusses

Discrete Elements

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*ELEMENT_DISCRETE

- Need: element ID, part ID
- 2 nodal point ID's, orientation, scale factor on force
- force vs. displacement is defined by *MAT_SPRING
- force vs. velocity is defined by *MAT_DAMPER

*SECTION_DISCRETE

- transitional or rotational
- dynamic magnification factor
- tension/compression limits

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**MAT_SPRING_option*

- Elastic
- elastic-plastic (E, Et, SGMY)
- nonlinear elastic
- inelastic (allow tension or compression only)
- general nonlinear (negative or zero slope allowed in the F vs. D curve)
- Maxwell (exponential decay of stiffness)
- Etc.

**MAT_DAMPER_option*

- Viscous
- nonlinear viscous
- Etc.

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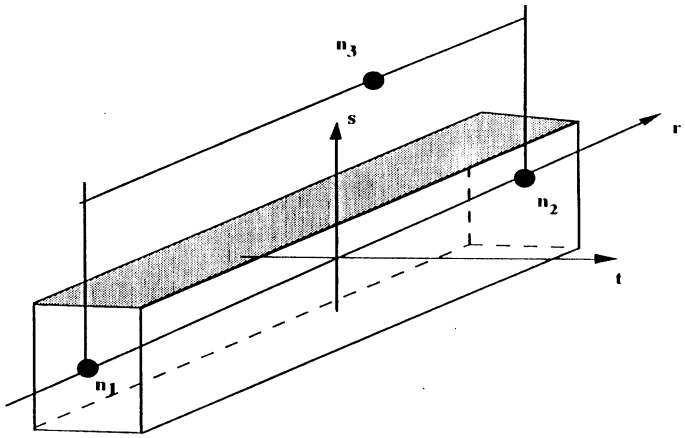
*ELEMENT_BEAM

- Need: element ID, part ID, 3 nodal point ID's

***SECTION_BEAM**

- Truss (axial deformation only)
- Beam (axial, bending, torsional deformations)
- Different beam formulation
- Different cross-sections
  - Rectangular, tubular, arbitrary
  - Area and inertia's
- Warping is also included



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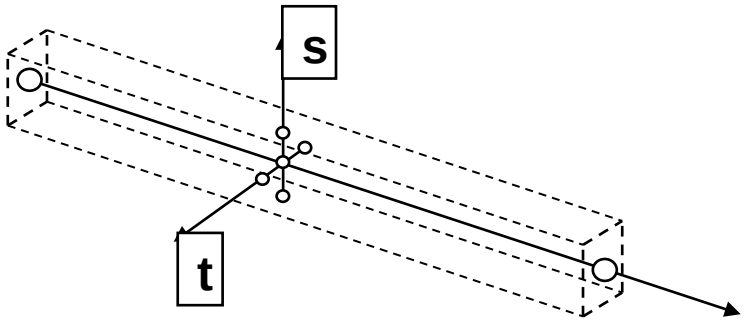
*ELEMENT_BEAM

- Hughes-Liu: type 1 (DEFAULT), recommended
  - 6 DOF per node: (dx, dy, dz, rx, ry, rz)
  - One integration point along length
  - Integrated cross section (not "resultant" beam)
  - Transverse shear correction factor
  - Moveable mid-plane option
  - s, t directions defined by orientation node n3



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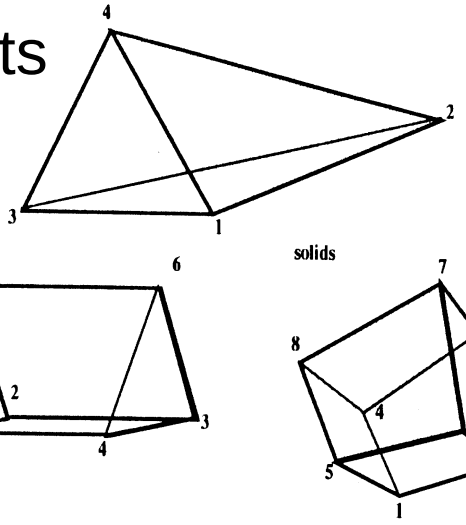
*ELEMENT_SOLID

- Need: element ID, part ID, 8-noded for brick

*SECTION_SOLID

- Different formulation
- 8-noded reduce integration
- 8-noded fully integrated
- Ted, Wedge, linear and nonlinear elements
- other elements for coupled applications



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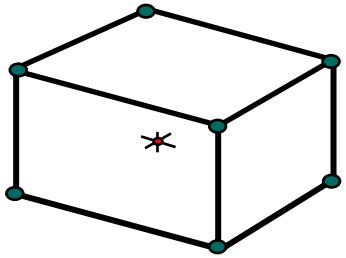
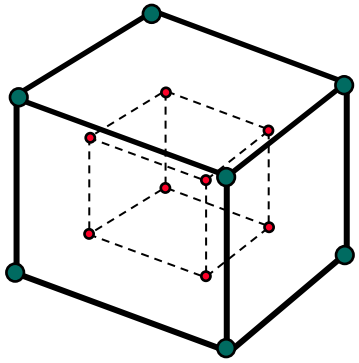
*ELEMENT_SOLID

- Constant Stress Solid: type 1 (DEFAULT)
  - Single point integration with hourglass control
  - Requires hourglass control
  - Can sustain large nonlinear deformation



- Fully Integrated S/R Solid: type 2
  - 3 DOF per node: (dx, dy, dz)
  - 2x2x2 selective/reduced integration
  - No hourglass control needed



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*ELEMENT_SHELL

- Need: element ID, part ID, 4 nodes for quads
- thickness can be defined in element card

*SECTION_SHELL

- Different Formulations
- Plane & axisymmetric element are defined as shells
- Linear and nonlinear shells
- Reduced and full integrated shells
- Other coupled and special elements

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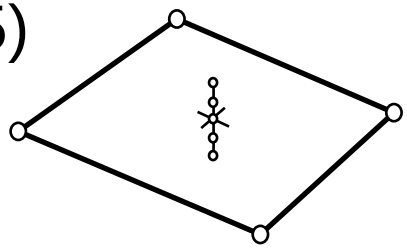
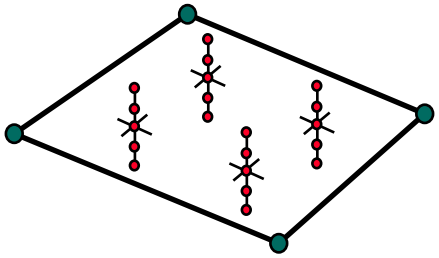
*ELEMENT_SHELL

- Belytschko-Tsay: Type 2 (DEFAULT)
  - 6 DOF per node: (dx, dy, dz, rx, ry, rz)
  - Single point integration with hourglass control
  - Requires hourglass control (type 4 or 5)



- Fast Shell: type 16, recommended
  - 6 DOF per node: (dx, dy, dz, rx, ry, rz)
  - 2x2 integration with enhanced strain formulation



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*ELEMENT_TSHELL

- Need: element ID, part ID, 8-noded

***SECTION_TSHELL**

- one point integration and selective reduce integration
- Similar to solid element with enhancement based on shell formulations.
- To obtain shell like behavior it is necessary to have several integration point through the thickness while employing plan stress constitutive equations.

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Notes

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Notes

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