Latest Features in LS-PREPOST 2.1

5th German LS-DYNA Forum
Ulm, Germany

October 13, 2006

LSTC Livermore Software Technology Corp.

Outline of Presentation

LS-PREPOST

- Current Status of LS-Prepost
- New features in General functions
- Geometry and Meshing
- Pre-Processing
- Post-processing
- Metal Forming Interface
- Scripto
- Current and future developments

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Current Status of LS-Prepost

LS-PREPOST

- LS-Prepost 2.1 has been released
- LS-Prepost 2.1is the standard pre- and post-processor for LS-DYNA on PC/Windows
- LS-Prepost 2.1can be freely download from ftp://ftp.lstc.com/outgoing/lsprepost2_1
- LS-Prepost 2.1 for PC/Windows is much more robust and stable than previous versions
- 64bit version is available for both Unix, Linux, and Win64

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Current Status of LS-Prepost

LS-PREPOST

- Online documentation is available at http://www.lstc.com/lspp
- There are 9 tutorials online that give step-by-step instructions on how to create model and data. More tutorials will be added over time
- Frequently Asked Questions is also available online to help users
- Linkage to other LS-DYNA support sites

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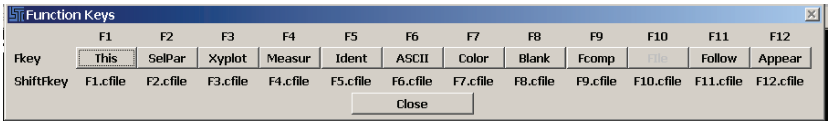
New Features in General Function

Function keys assignment

- F1 brings up the function key panel showing the current mapping of interface panels to F-keys. F2-F12 open whatever interface panel is linked to the function key pressed
- The mapping of panels to F-keys can be defined in the configuration file. For example, adding "fkey2 = ptrim" to .lspostrc would cause the PTrim panel to open when F2 is pressed.



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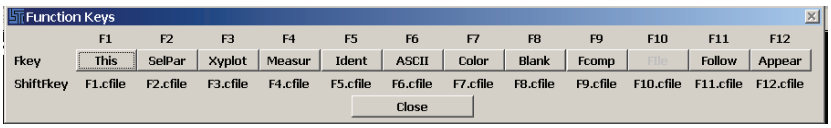
New Features in General Function

Function keys assignment

- Custom keys are Very useful for repetetive tasks that should be performed directly after reading for instance a d3plot file.
- Example of useful commands to place in such file can be:
  - Set specified color for each part
  - Read in a group file
  - Set ”no average” for colors in fringe plots
  - Set ”User Range” values
  - Etc.



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New Features in General Function

- Command line execution without graphics
  - Lsprepost c=command.cfile –nographic
- Will only work with operation that does not require extraction of graphical images
- For example operations on ASCII history files, extract xy history data and save them in files
- Rename file lspost.cfile to become user's command file
- Command structure is not yet documented but can be easily understood

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Geometry and Meshing

- Curves/Lines interface
- Surface interface
- 2D-Meshing
- Simple Geometry Meshing
- Tetrahedron mesher and surface re-mesh
- Nlines meshing
- Surface meshing
- Block meshing

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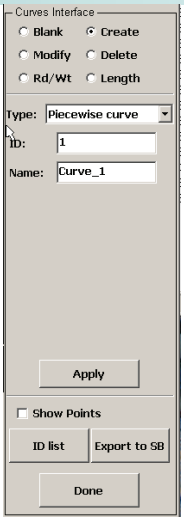
Geometry – Curves/Lines

Page 2 or Page 7 Curves – To show/create/modify curves

- Curves can be created by inputing the xyz coordinate of a point.
- Or from picking positions on the existing mesh
- Or from picking an edge of an element
- Or imported from an Iges file, Vda, or piecewise data points format
- Arcs or circle can easily be created
- The total length of a curve can be computed
- Curves can be exported in Iges/Vda/xyz format



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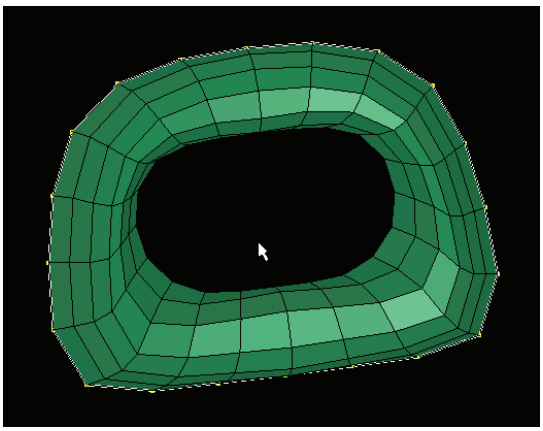
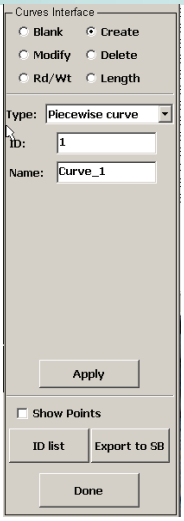
Geometry – Curves/Lines

- Curve Creation by picking edge with propagation





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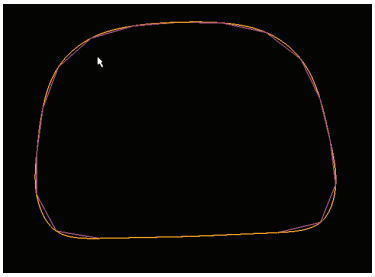
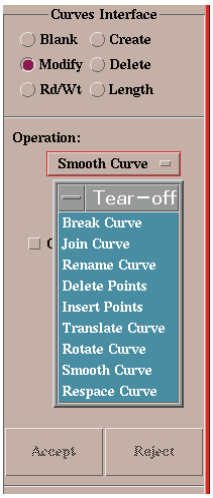
Geometry – Curves/Lines

- Curve Modification operation
  - Break Curve
  - Join Curve
  - Rename Curve
  - Delete Points
  - Insert Points
  - Translate Curve
  - Rotate Curve
  - Smooth Curve
  - Re-space Curve





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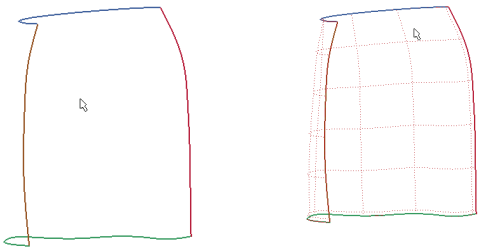
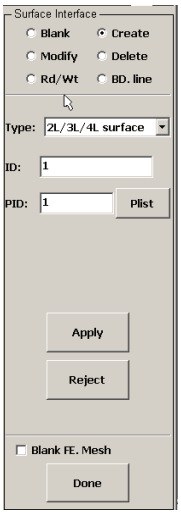
Geometry – Surface Interface

Page 7 Surface – To show/create/modify/delete and export surfaces

- Surfaces can be imported via Iges or Vda files
- Surfaces can be created by 2/3/4line that form the boundary





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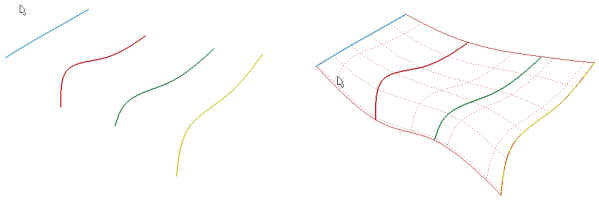
Geometry – Surface Interface

Page 7 Surface – To show/create/modify/delete and export surfaces

- Surfaces can be created by lines that define the skin of the surface
- Surfaces data can be exported in Iges/Vda format



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Meshing – 2D Meshing

- Interface in 2D Sketch board has been revised and is more robust
- 2D sketch can be used to create closed boundary
  - Points, lines, arcs, circles will make up the boundary
  - Lines and arcs can be trimmed and/or extended to other lines and arcs
  - A fillet with a specified **Radius** can be created between lines and/or arcs
- Lines/Curves can also be imported from Curves interface
- Points/Lines can be translated and rotated with or without copies
- A sketch board edge is created from one or several curves

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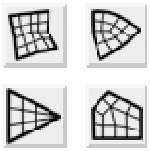
Meshing – 2D Meshing

- Number of elements and bias are defined on edges
- Meshing can be done with 4 different techniques
  - Topologic 4-Edge fill with quadrilateral elements
  - Topologic 3-Edge fill with quadrilateral elements
  - Topologic 3-Edge where the structured mesh degenerates in one corner
  - An arbitrary shaped area with optional holes in it will be filled with a non-structured mesh with only quadrilateral



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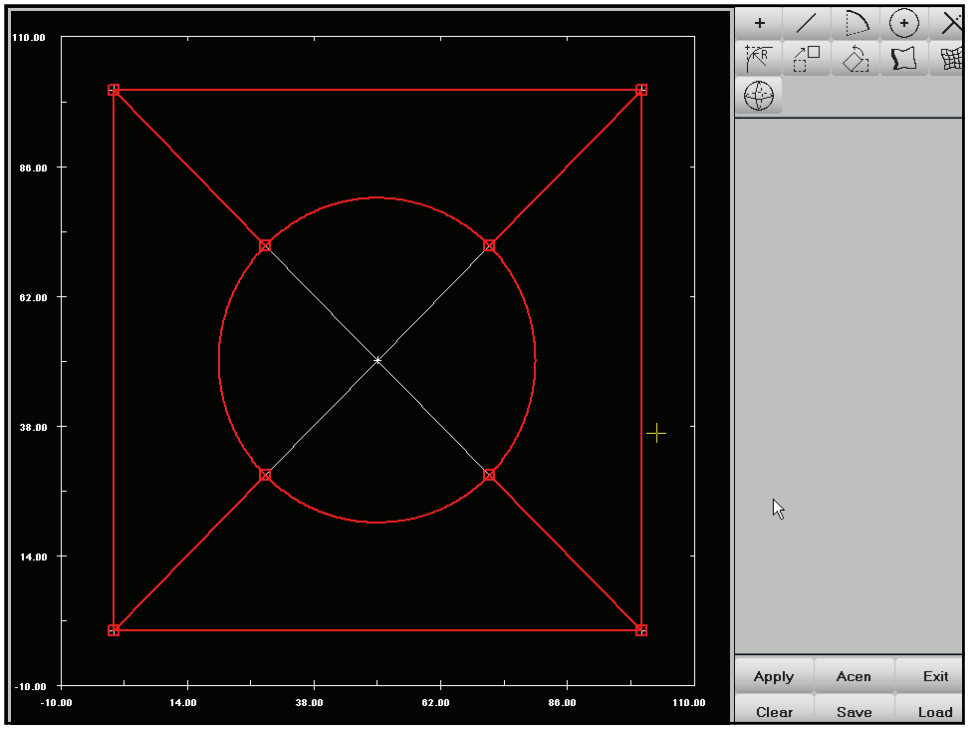

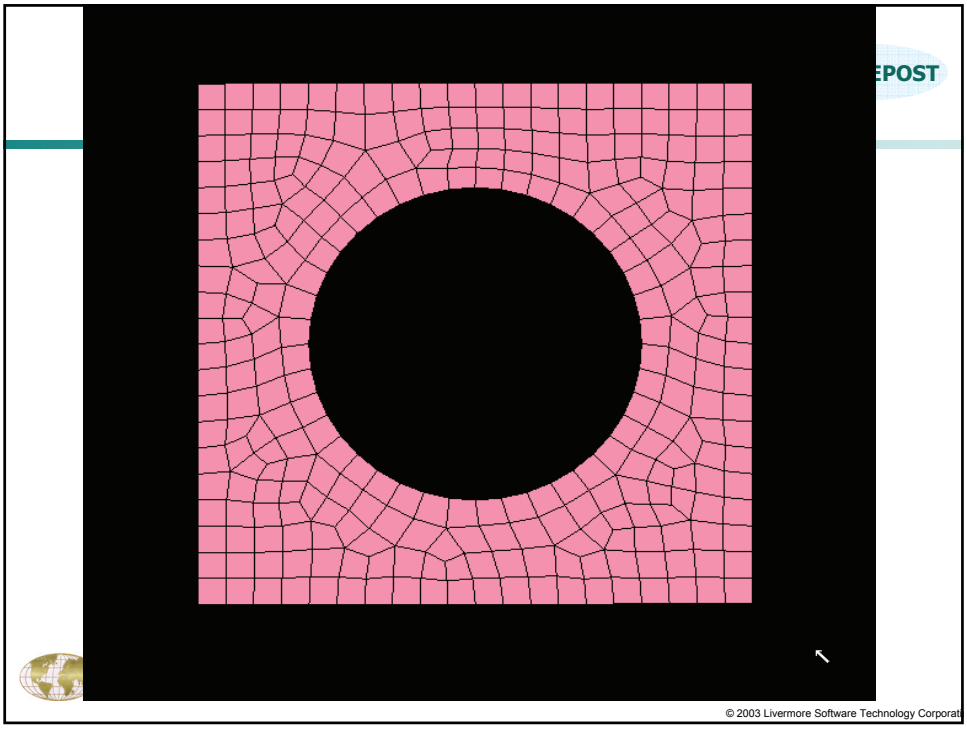

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Meshing – Simple Geometry

- Page 7 – Mesh button
- To generate simple shape geometries
- Box (Cube) – define min and max points
- Flat Shell – define 4 points
- Cylinder – define radius, and vector along the cylinder
  - Solid or Shell – can be capped or hollow
- Sphere – define radius, and density which is the no. of elements in a 90 degree segment
  - Solid or Shell
- Accept and Reject buttons

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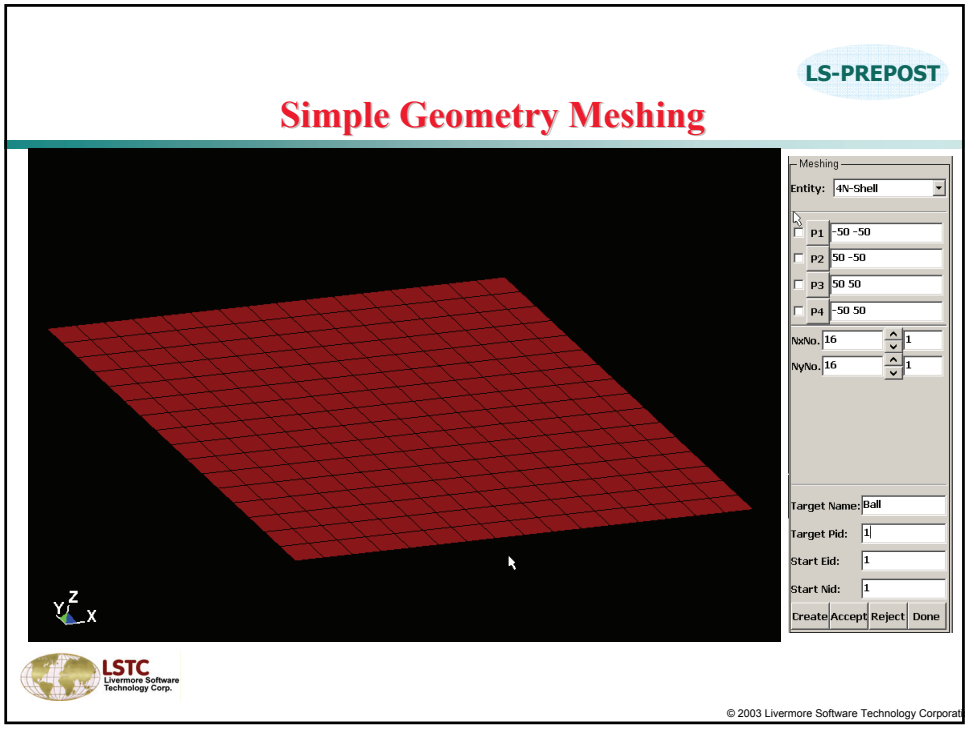

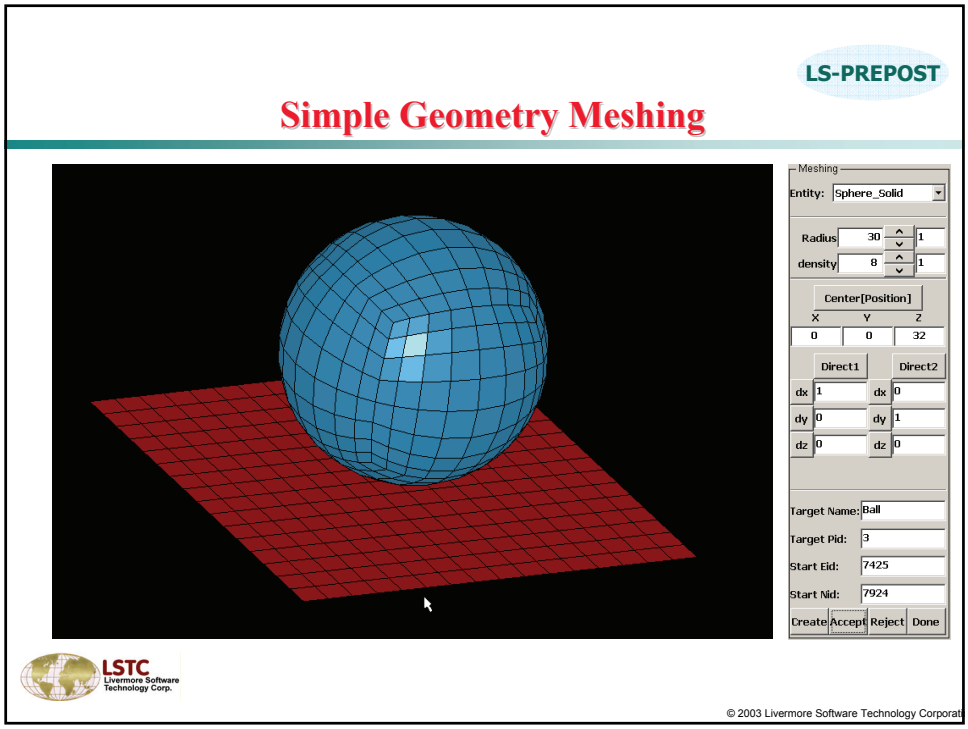

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Tetrahedron Mesher and Surface Remesh

- A solid tetrahedron mesh is produced from a good enclosed surface mesh.
- Distorted, or rather irregular surface meshes will not produce a good tet mesh. The surface must be cleaned up by merging small triangles, and remeshing.
- A solid part can be skinned and used as an enclosed surface.
- Skin only form a connected solid. Later will skin an unconnected solid by selecting the outer surface

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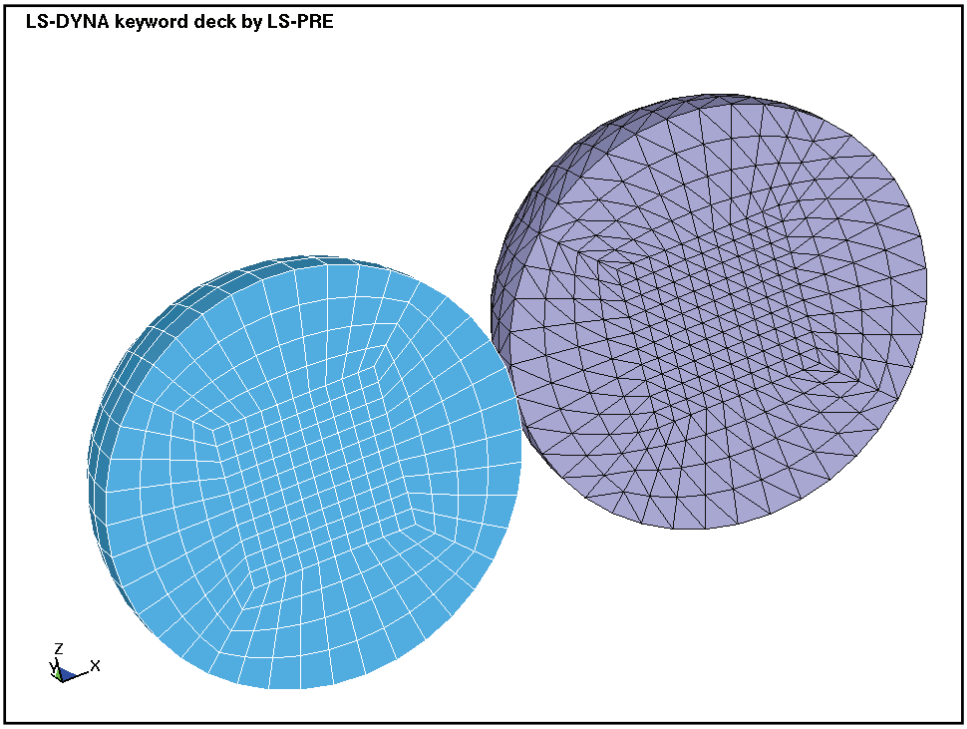

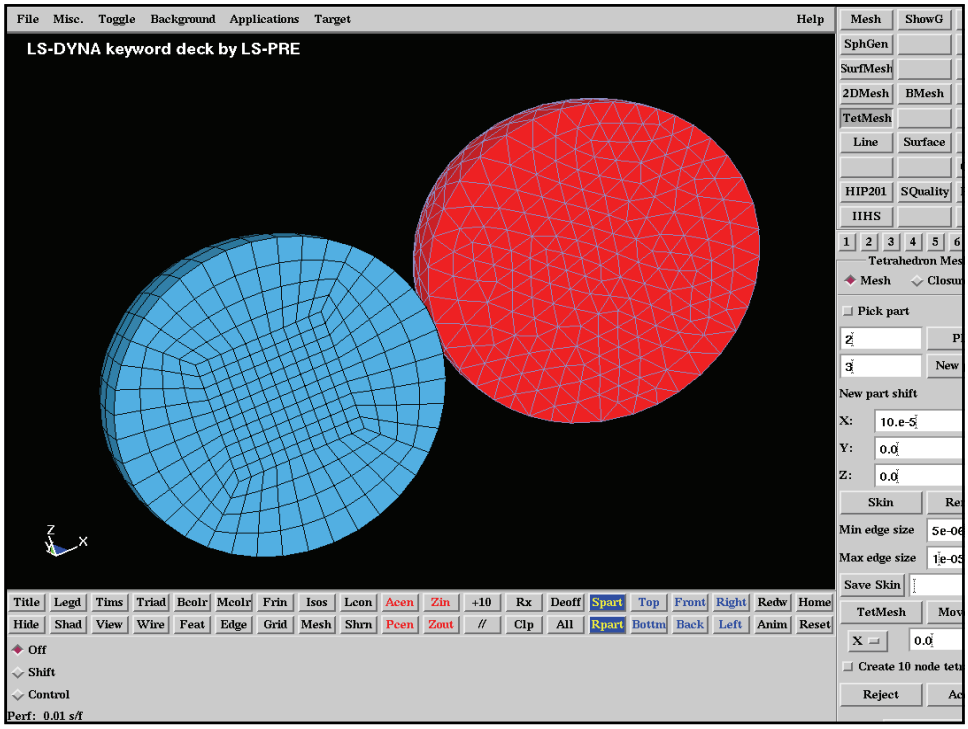

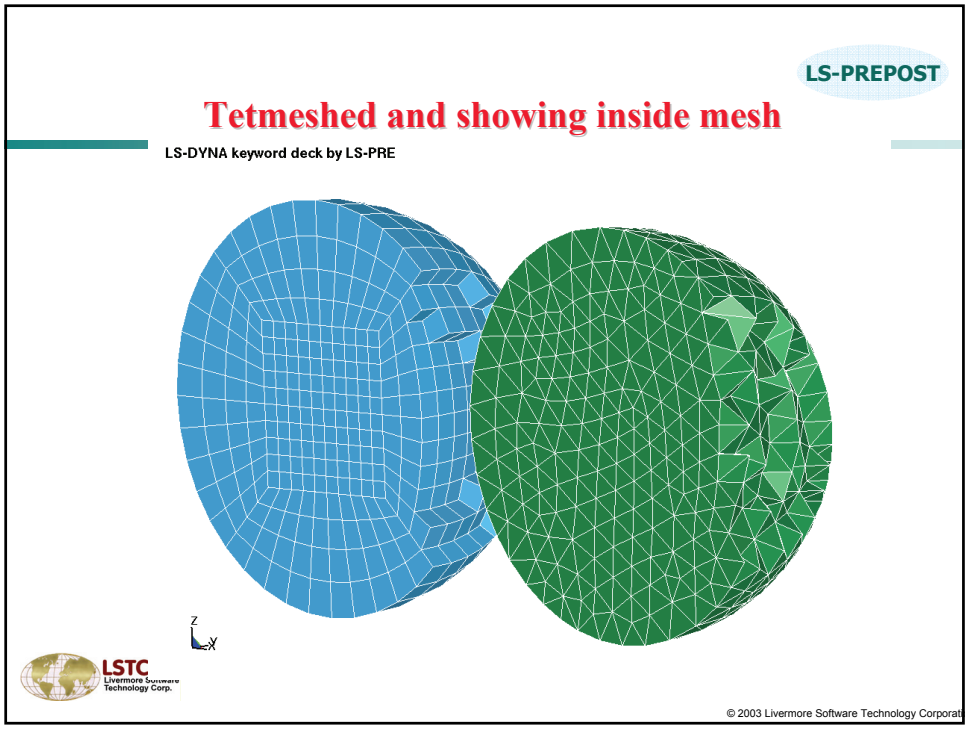

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Meshing - NLMesh

Page 7 - nLMesh

- 2 Line shell – Create shell mesh between 2 curves
- 3 Line shell – Create shell mesh bounded by 3 curves
- 4 Line shell – Create shell mesh bounded by 4 curves
- Line Sweep - Create a mesh by sweeping one line along another line
- Meshing density can be selected from
  - No. of elements on line
  - Element size
  - Point of line

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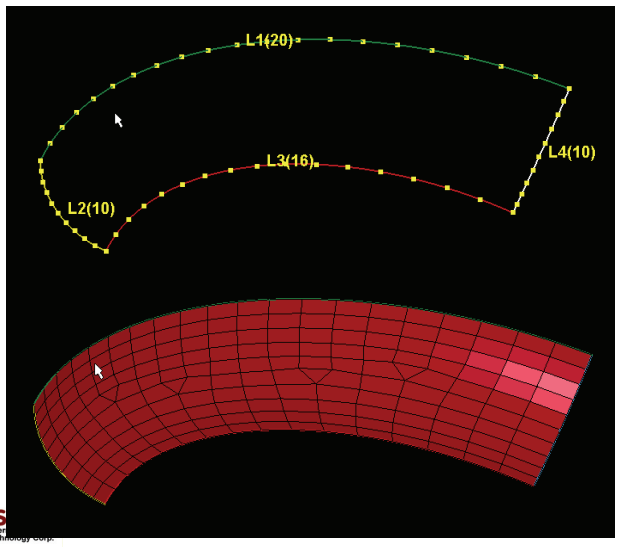
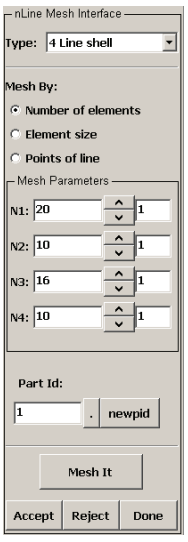
Meshing - NLMesh





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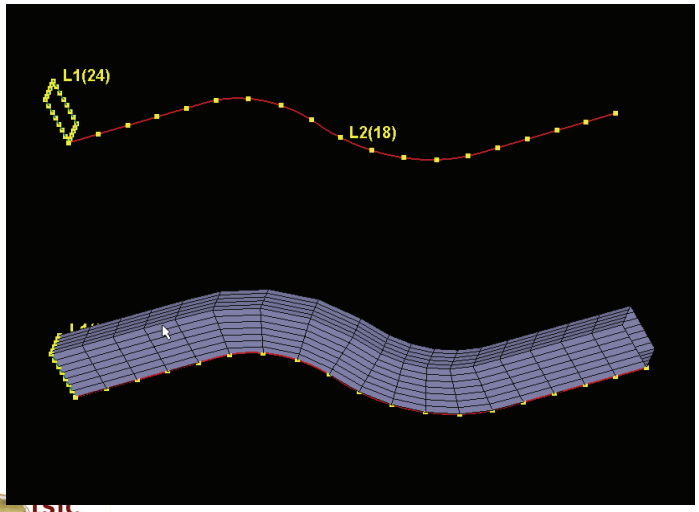
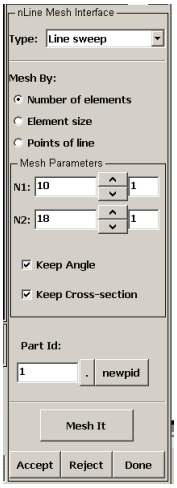
Meshing - nLMesh Line Sweep





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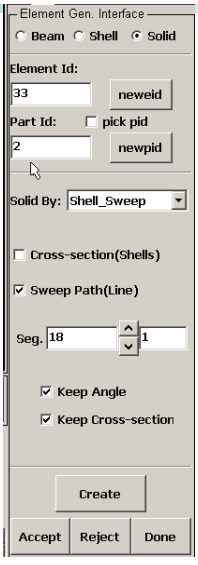
Sweep 2D Cross-section into Solid

Page 2 – ElGen->Solid->Solidby Shell Sweep

- Select cross-section shell elements
- Select curves
- Assign number of elements along the curves
- Turn on “Keep Angle”
- Turn on “Keep Cross-section”



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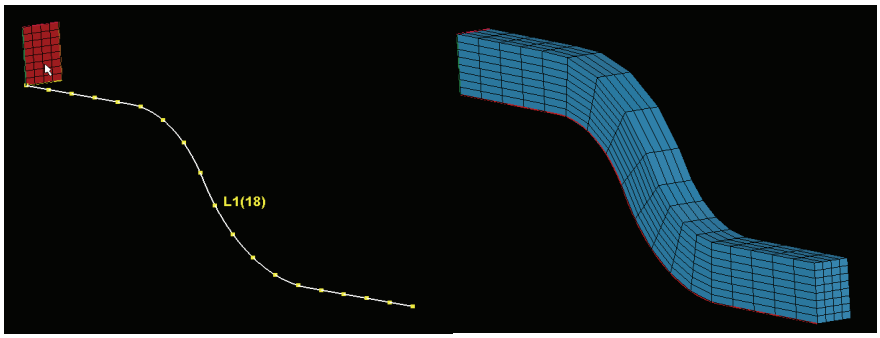
Sweep 2D Cross-section into Solid



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Pre-processing

- LS971 keyword support
- Element material direction input
- Mesh smoothing
- Spotweld generation
- Sph particle generation (new interface and capability)

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LS971 Keyword support

More LS970/LS971 keyword data are supported (some examples)

- *Keyword_ID
- *Ale_Tank_Test
- *Ale_Fsi_Switch_MMG
- *Control_Forming_Template, Travel, Position
- *Control_Adaptive_Curve
- *Control_EM
- *Control_Shell (new data cards)
- *Constrained_Interpolation_local
- *Define_friction
- *Element_Solid_Tet4ToTet10
- *Initial_Stress_Solid (new data cards)
- *Node_Scalar_Value

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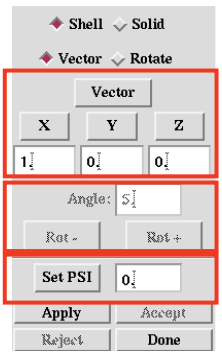
LS-PREPOST

Element Material Direction

Page 2, ElEdit - Direction

- Sets default material direction for *selected* elements, the direction used when AOPT=0 on *MAT card, using _BETA for shell and _ORTHO for solid elements
- Shell orientation can be set using three methods
  - Apply orientation by vector
  - Incrementally rotate orientation angle + / -
  - Explicitly set PSI angle



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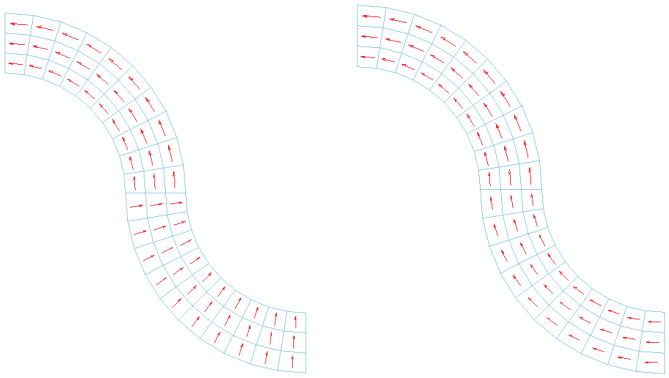
Element Material Direction

Shell orientation is drawn as an arrow for each element

Orientation rotated 90 degrees for the lower half of the part below



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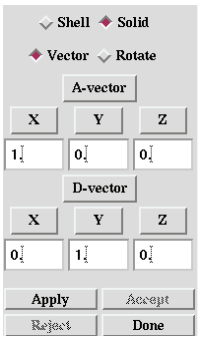
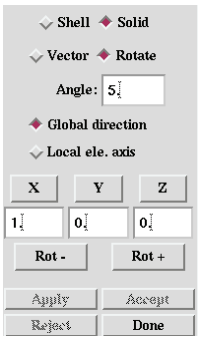
Element Material Direction

Solid element orientation can be set using two methods

- Apply orientation by A and D vectors
- Incrementally rotate orientation about global vector or about currently local element axes





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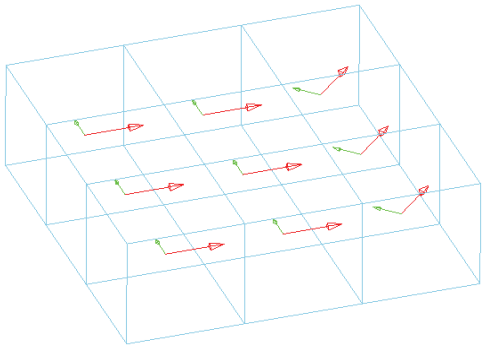
ElEdit - Direction

Solid element orientation

- A direction is shown as red arrow.
- B direction is shown as a shorter green arrow.



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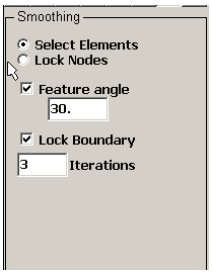
Mesh Smoothing

Page 7 Smooth

- Shell and solid elements can be smoothed with simple average and projected back on the original element position
- Nodes on the boundary can be optionally be locked
- Boundary nodes for shell are the ones belonging to free edges
- Boundary nodes for solid element are the ones belonging to outer faces of the selected solid elements



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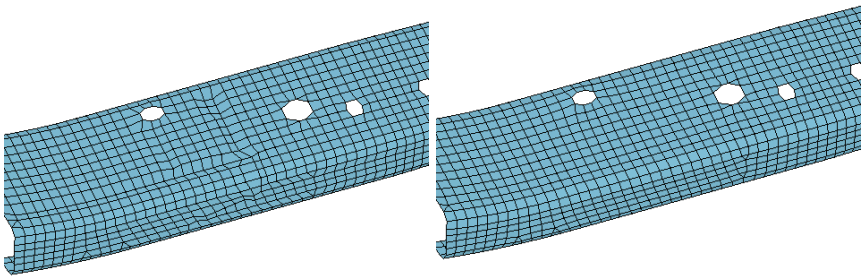
Mesh Smoothing

Page 7 Smooth



Before smooth

After smooth with locked boundary

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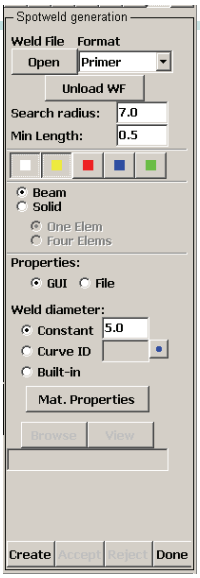
LS-PREPOST

Spotweld Generation

Page 7 SWGen - to generate spotweld elements from a spotweld file

- Spotweld information from file
  - Primer format
  - MWF (Master Weld File) format
  - XML format
  - Custom (User defined) format
- It can generate both **solid** and **beam** type 9 spotweld elements
- Following keywords will be generated
  - *Part, *Section, *Set_Node, *Set_Part
  - *Mat_Spotweld, *Hourglass,
  - *Contact_Spotweld



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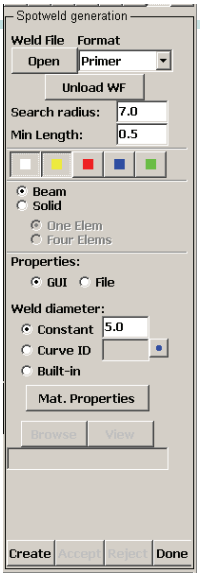
Spotweld Generation

- Spotweld can be created with defined search radius and minimum length
- Color coded buttons to display weld information
- Constant diameter or defined by Curve can be used
- Solid element can has 1 or 4 elements
- Material properties can be defined in the Material form

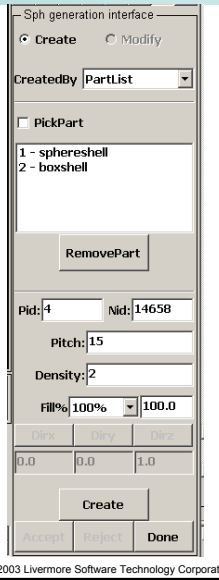


LS-PREPOST

SPH Generation

Page 7 Sphgen – To create SPH particles with different fill level

- Create SPH by the following methods
  - Box – define min/max points
  - Sphere – define position and radius
  - Cylinder – define position, radius and length along with the direction of the cylinder
  - FromHex – Hex parts, use existing nodes
  - Partlist – Enclosure by shell parts
- Pitch – distance between particles
- Density is used to compute particle mass
- Fill level can be less than 100%
- Give direction of gravitation force

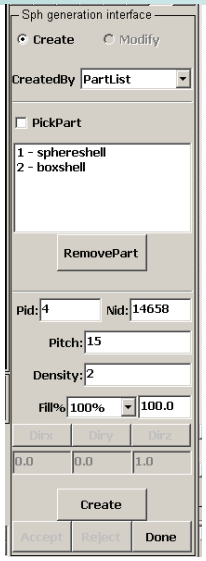


LS-PREPOST

SPH Generation

Created By Partlist

- Only Shell part can be used
- Can use multiple parts
- Shell parts should form an water tight enclosed volume
- Normals of shell should be consistent and pointing outward
- Shell thickness will be taken into account for particles close to the boundary



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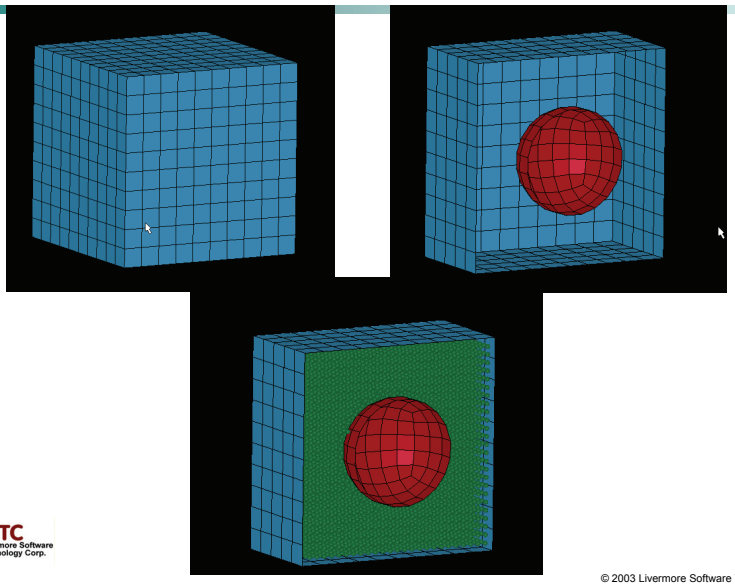
SPH Generation



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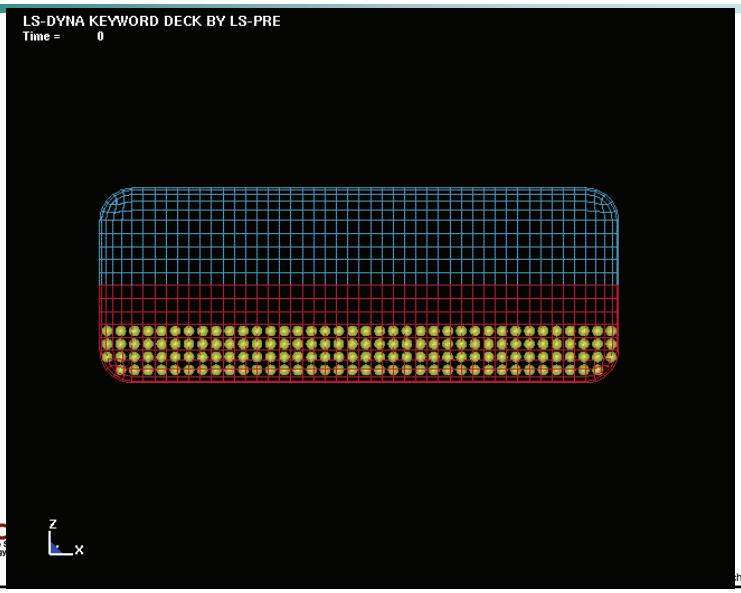
Fuel Tank Sloshing with Partial Fill

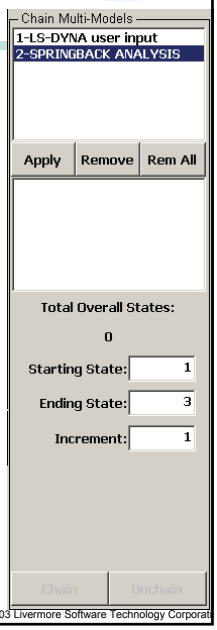


LS-PREPOST

Post-Processing

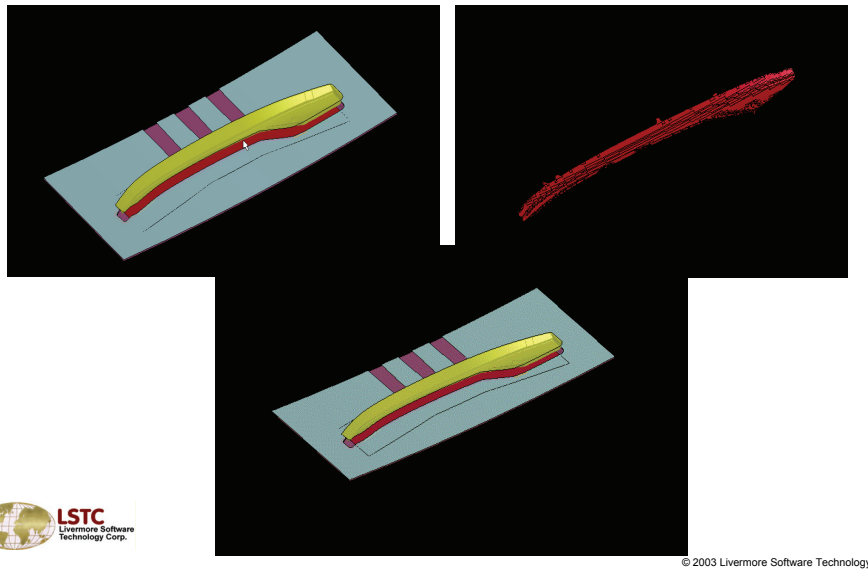
Model Chaining – Page 7 ChainM – To chain multiple models into one single animation sequence

- Read in more than 1 post-processing (d3plot) models
- Use Apply button to move the selected model into the chain sequence
- Start and end states can be controlled, default to all states
- Once models are selected, press Chain to apply chaining



LS-PREPOST

Post-Processing



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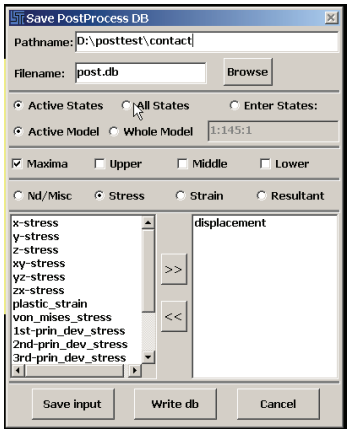
LS-PREPOST

Post-Processing

Interactive saving of post.db file

- Post.db file is a subset of d3plot
- Whole model or only active parts/elements
- All states or selected states
- Select components to be save, displacement is default
- Post.db file can be read from Pull down menu:
  - File->Open->Database file
- Post.db file can be moved to different computer system with different endian
- 32bit post.db file can be read in 64bit lsprepost
- 64bit post.db file can also be read in 32bit machine as long as the file is less then 2GB



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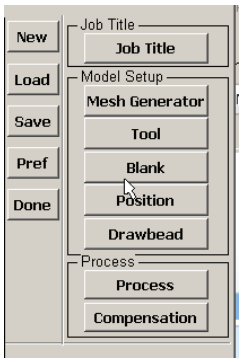
LS-PREPOST

New Metal Forming Interface



Pulldown menu Application->Metalforming to activate the interface

- New – Build new project
- Load – Load project file
- Save – Save project file
- Pref – User preference dialog
- Done – Go back to general interface

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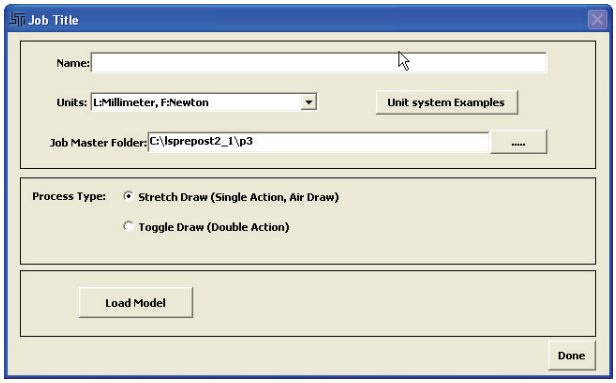
New Metal Forming Interface

Job Title – Define name, Units, master folder and Process type. Can also load existing model (nodes and elements) from here



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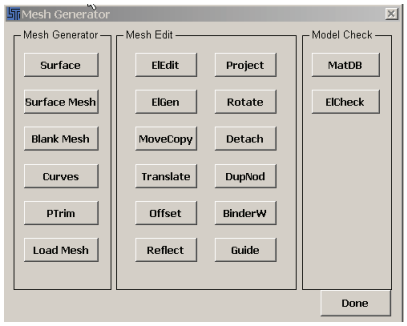
New Metal Forming Interface



- Mesh Generator – provide interfaces to various mesh creation and manipulation without going back to the main button manuals on different pages
- Mainly to create and edit the finite element mesh

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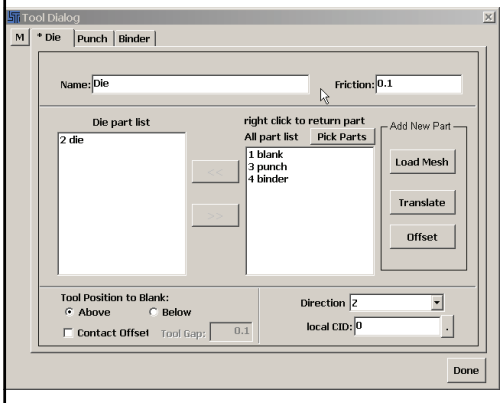
New Metal Forming Interface



- Tool Interface – To setup tool parts like Die, Punch, Binder, etc.
- User can use the M button to add or remove tools
- Friction coefficient is set here
- Direction of the tool movement is set
- Tool position relative to the blank is also set here

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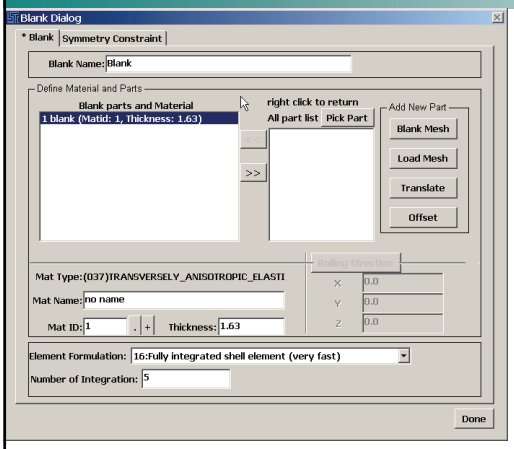
New Metal Forming Interface



- Blank interface – To setup blank
- Define blank material, element formulation and thickness
- For certain material, rolling direction also can be set

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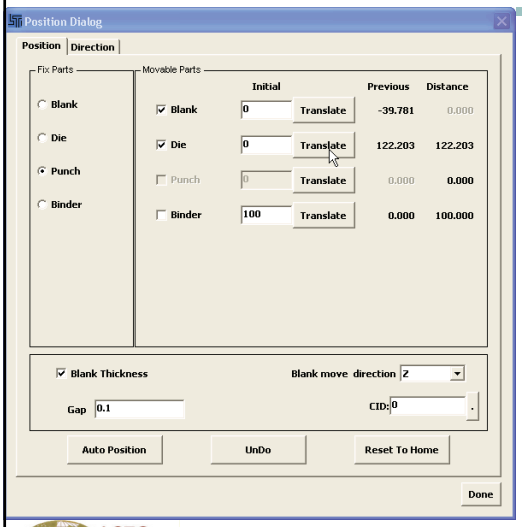
New Metal Forming Interface



- Position interface – To position tools and blank with respect to each others
- Blank thickness can be taken into account
- Allow Gap between blank and tools
- Auto Position will move parts automatically based on their positive relative to each others

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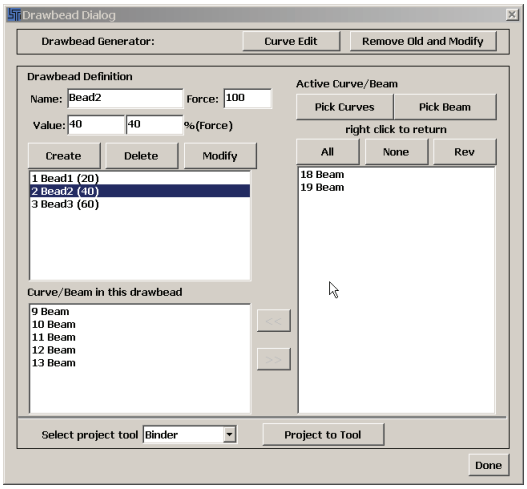
New Metal Forming Interface



- DrawBead interface – To assign curves/beams as drawbeam
- Define the bead force
- Select tool to project to
- Perform projection of drawbead to Tool

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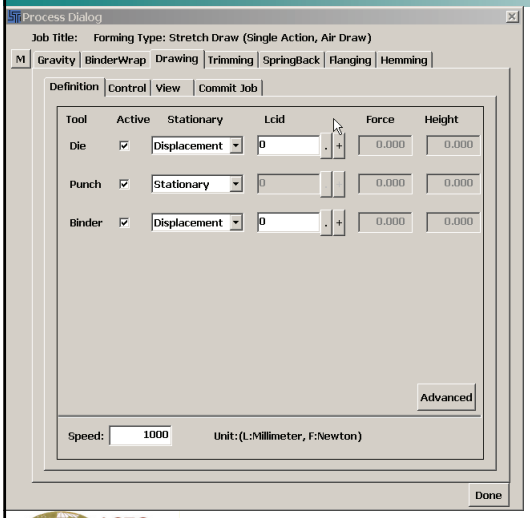
LS-PREPOST

New Metal Forming Interface



- Process interface – To define type of process, like Gravity, BinderWrap, Drawing, Trimming, Springback, Flanging, Hemming
- User can add or remove processes
- Different process has different definition
- Drawing Definiton - Define if tool is stationary or displacement/velocity/force control

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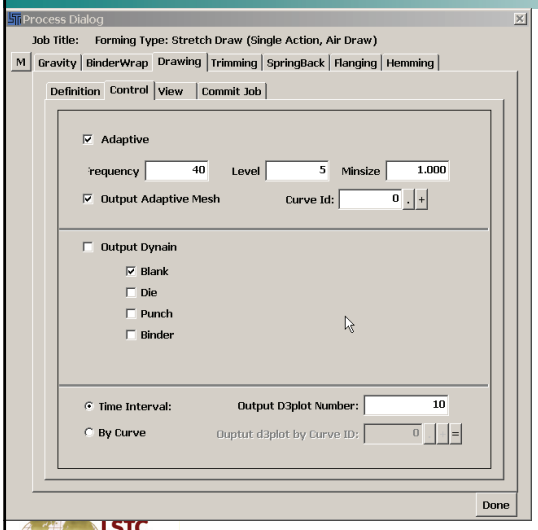
New Metal Forming Interface



Process control interface – To define the control parameters of a process

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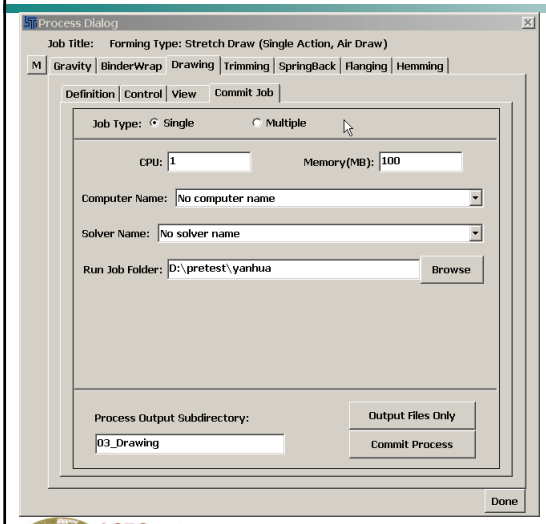
New Metal Forming Interface



Process commit interface – To define how a job is going to be executed

No. of CPUs

Memory usage

Solver name: (different version of LS-DYNA)

Run job directory

Final keyword file can be written here

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Scripto

- SCRIPTO – stands for the scripting objects. It is a new tool that allows user to interface directly with LS-PREPOST through scripts
  - Re-design or Simplify the user interfaces
  - Re-group or re-organize the functions available in the LS-PREPOST
  - Integrate with other application to introduce new capabilities to LS-PREPOST

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LS-PREPOST

SCRIPTO

- SCRIPTO – is a set of application programming interface (API) functions, that allows user to
  - Create new users interfaces
  - Interact with loaded models
  - Utilize mechanisms developed in the LS-PREPOST
- Scripts are developed in a C-like language and thus benefit those users that has C-language experience.
- Parsed scripts become part of the new running instance of LS-PREPOST.

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LS-PREPOST

Current and Future Developments

- Display failed spotwelds with fringing
- Fringe component data with local coordinate system
- Use expression (equations) in command file and macro commands
- Fringe component data with equation expression
- User defined equation expression for history data operations
- More geometry data creation and manipulation
- Block meshing based on index space mapping
- More LS-DYNA data checking and cleaning

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