

Latest Features in LS-PREPOST 2.1

***5th German LS-DYNA Forum
Ulm, Germany***

October 13, 2006




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 2.1 has been released
- LS-Prepost 2.1 is the standard pre- and post-processor for LS-DYNA on PC/Windows
- LS-Prepost 2.1 can 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

- Online documentation is available at <http://www.lstc.com/lsp>
- 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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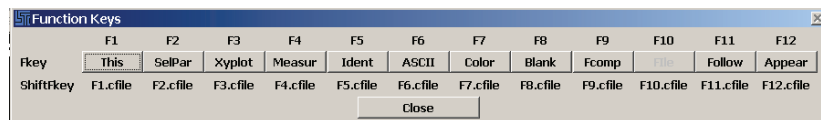
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New Features in General Function

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 .lsposrc would cause the PTrim panel to open when F2 is pressed.



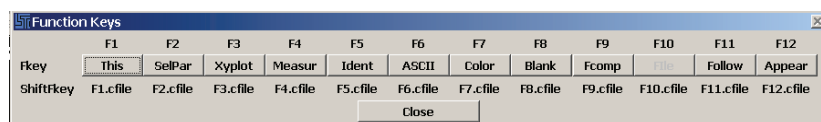
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New Features in General Function

Function keys assignment

- ❑ Custom keys are Very useful for repetitive 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 inputting 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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Curves Interface

Blank Create
 Modify Delete
 Rd/Wt Length

Type: Piecewise curve

ID: 1


Name: Curve_1

Apply

Show Points

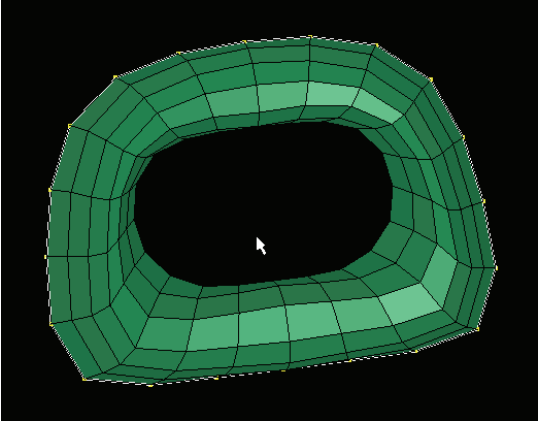
ID list Export to SB


Done



Geometry – Curves/Lines

- Curve Creation by picking edge with propagation





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Curves Interface

Blank Create
 Modify Delete
 Rd/Wt Length

Type: Piecewise curve

ID: 1


Name: Curve_1

Apply

Show Points

ID list Export to SB

Done



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

Curves Interface

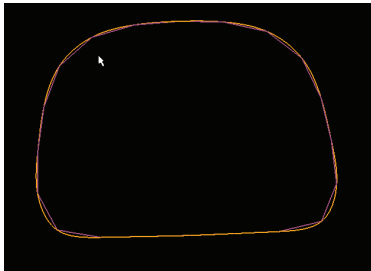
Blank Create
 Modify Delete
 Rd/Wt Length


Operation:

Smooth Curve


Tear-off

- Break Curve
- Join Curve
- Rename Curve
- Delete Points
- Insert Points
- Translate Curve
- Rotate Curve
- Smooth Curve
- Respace 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

Surface Interface

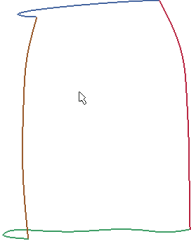
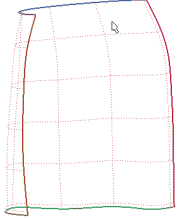
Blank Create
 Modify Delete
 Rd/Wt BD. line


Type: 2L/3L/4L surface

ID:

PID:

Blank FE. Mesh



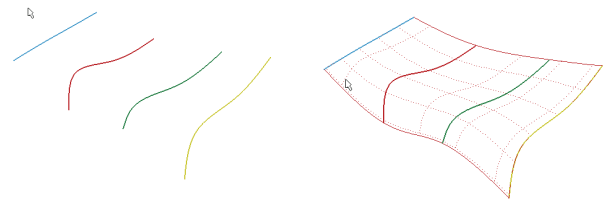
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Geometry – Surface Interface

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



Surface Interface

Blank Create


Modify Delete

Rd/Wt BD. line

Type: skin surface

ID: 1

PID: 1




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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

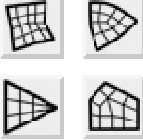



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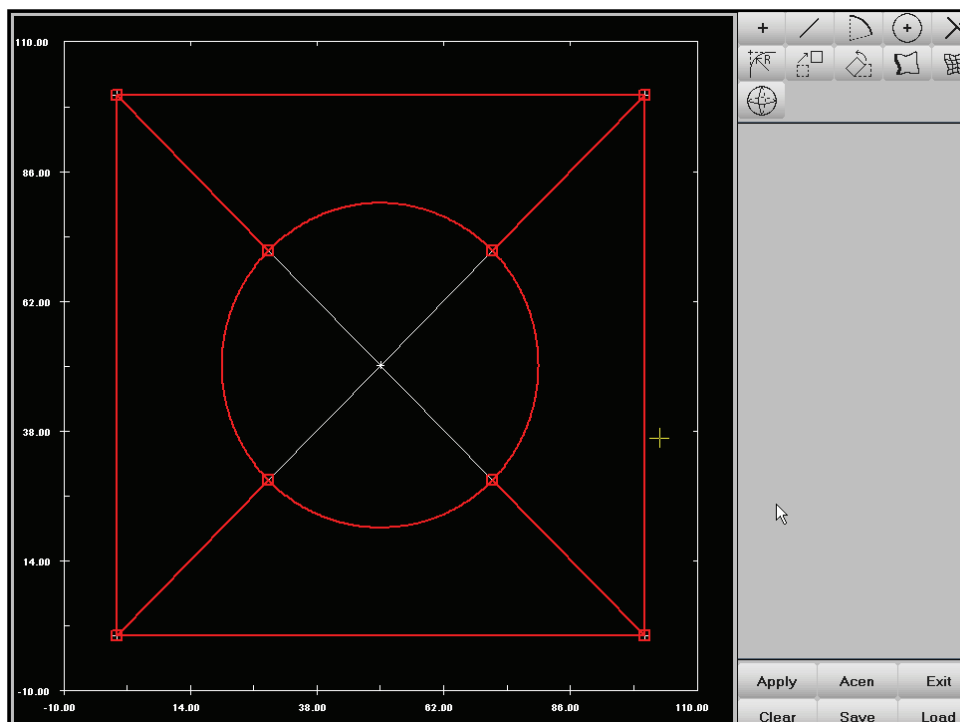


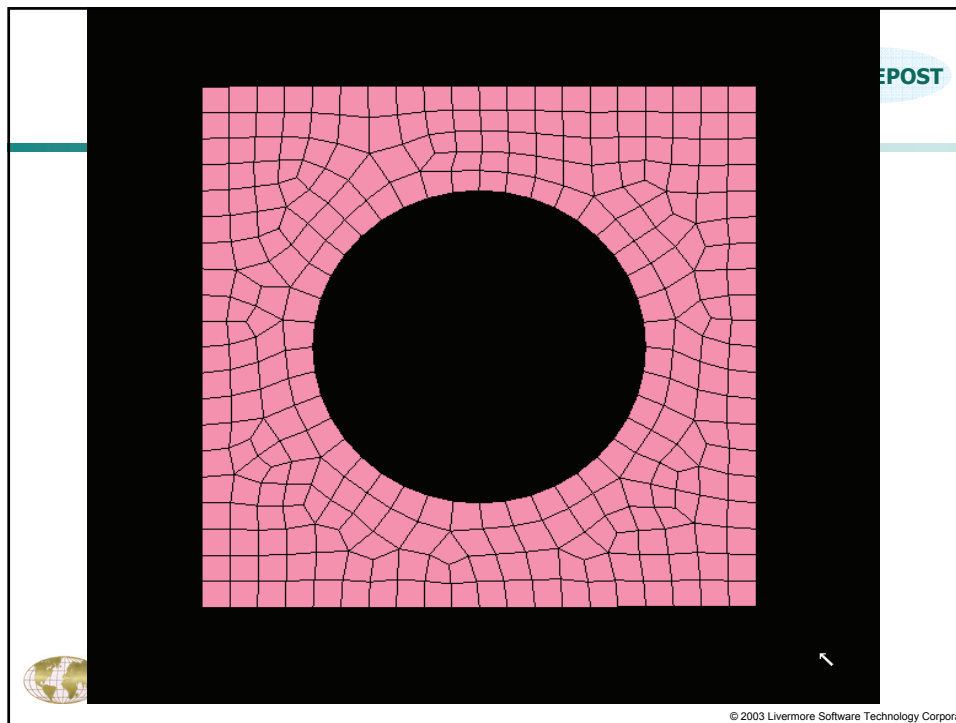
Meshing – 2D Meshing

- ❑ 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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Meshing – Simple Geometry

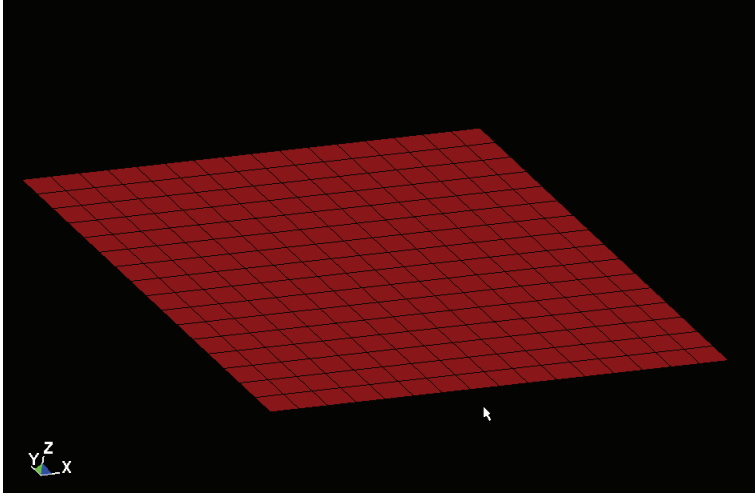
- Page 7 – Mesh button
- To generate simple shape geometries
- Box (Cube) – define min and max points
- Flat Shell – define 4 points
- Cylinder – define radius, and vector along the cylinder
 - ❖ Solid or Shell – can be capped or hollow
- Sphere – define radius, and density which is the no. of elements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

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Simple Geometry Meshing





— Meshing —

Entity: 4N-Shell

p1 -50 -50

p2 50 -50

p3 50 50

p4 -50 50

NxNo: 16

NyNo: 16


Target Name: Ball

Target Pid: 1

Start Eid: 1

Start Nid: 1


Create Accept Reject Done

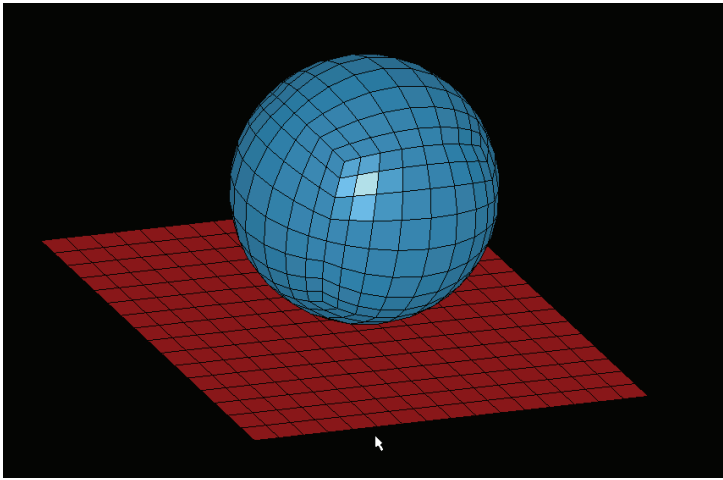


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Simple Geometry Meshing





— Meshing —

Entity: Sphere_Solid

Radius: 30

density: 8

Center [Position]

X	Y	Z
0	0	32

Direct1		Direct2	
dx	1	dx	0
dy	0	dy	1
dz	0	dz	0


Target Name: Ball

Target Pid: 3

Start Eid: 7425

Start Nid: 7924

Create Accept Reject Done



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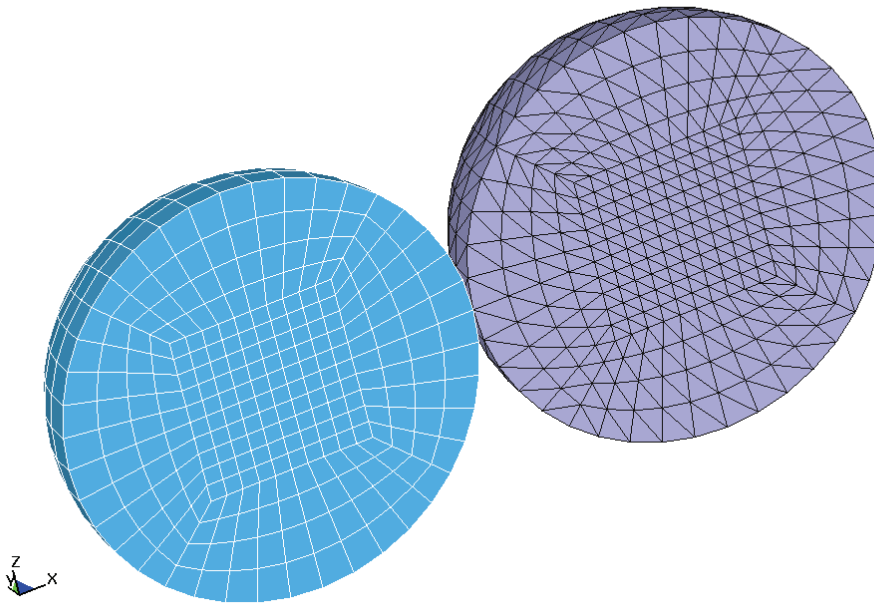
Tetrahedron Mesher and Surface Remesh

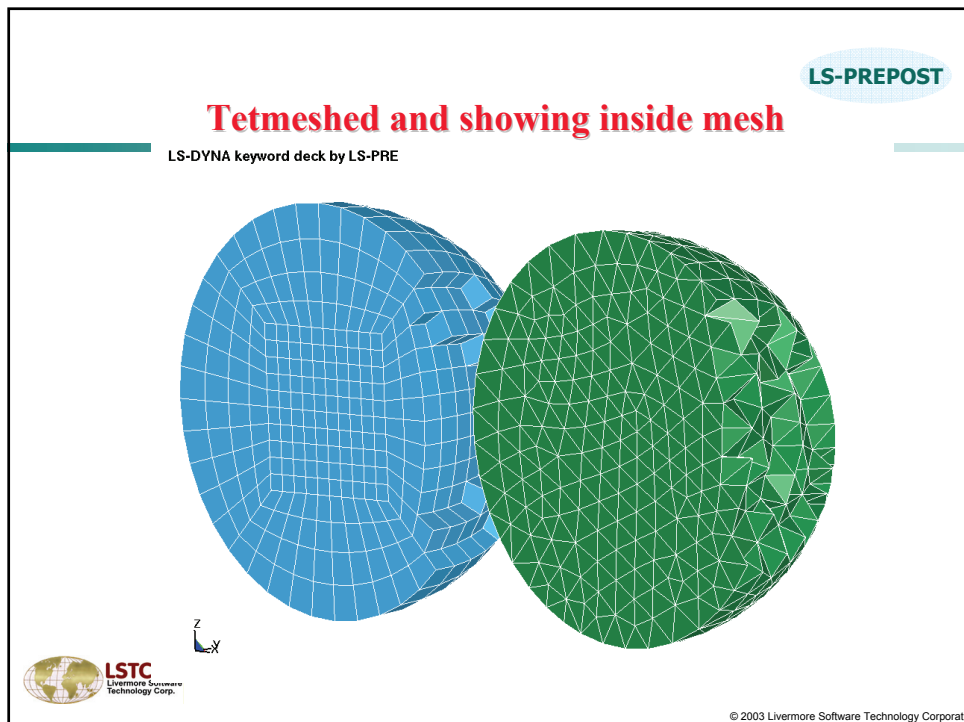
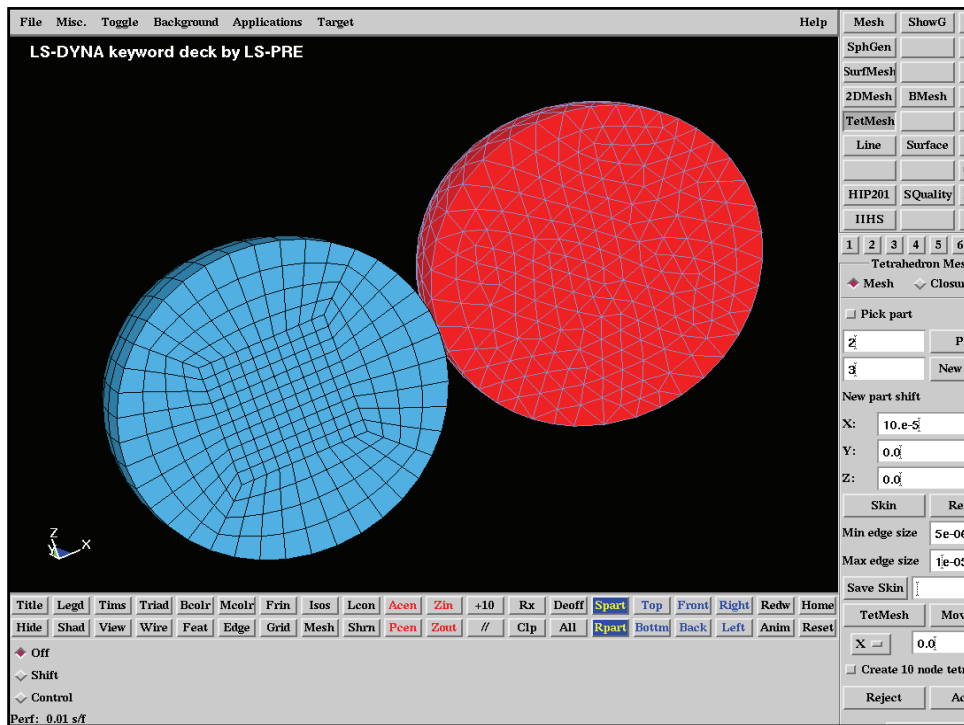
- ❑ A solid tetrahedron mesh is produced from a good enclosed surface mesh.
- ❑ Distorted, or rather irregular surface meshes will not produce a good tet mesh. The surface must be cleaned up by merging small triangles, and remeshing.
- ❑ A solid part can be skinned and used as an enclosed surface.
-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



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LS-DYNA keyword deck by LS-PRE






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Meshing - NLMesh

Page 7 - nLMesh

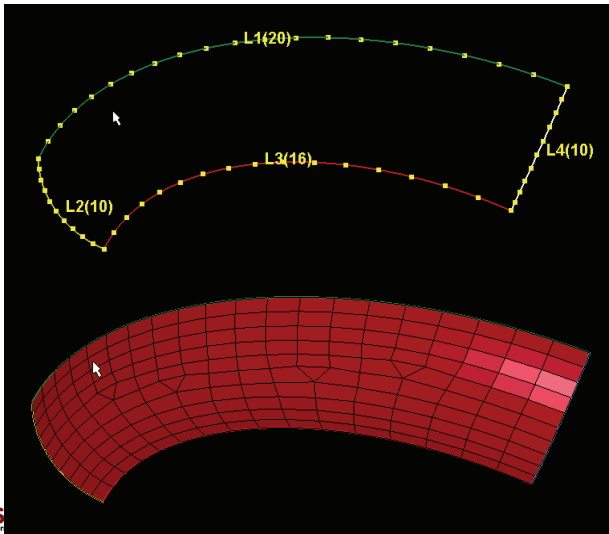
- 2 Line shell – Create shell mesh between 2 curves
- 3 Line shell – Create shell mesh bounded by 3 curves
- 4 Line shell – Create shell mesh bounded by 4 curves
- Line Sweep - Create a mesh by sweeping one line along another line
- Meshing density can be selected from
 - ❖ No. of elements on line
 -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



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Meshing - NLMesh



– nLine Mesh Interface –

Type: 4 Line shell

Mesh By:

Number of elements

Element size

Points of line

Mesh Parameters

N1: 20

N2: 10

N3: 16


N4: 10

Part Id:


1 . newpid

Mesh It

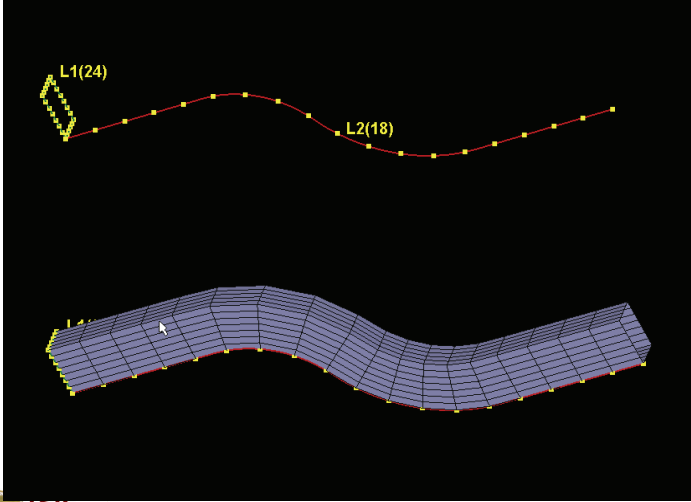
Accept Reject Done



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Meshing - nLMesh Line Sweep



nLine Mesh Interface

Type: Line sweep

Mesh By:

Number of elements

Element size

Points of line

Mesh Parameters

N1: 10

N2: 18


Keep Angle

Keep Cross-section


Part Id: 1 . newpid

Mesh It

Accept Reject Done



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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”

Element Gen. Interface

Beam Shell Solid

Element Id: 33 neweid

Part Id: pick pid 2 newpid

Solid By: Shell_Sweep

Cross-section(Shells)

Sweep Path(Line)


Seg. 18

Keep Angle

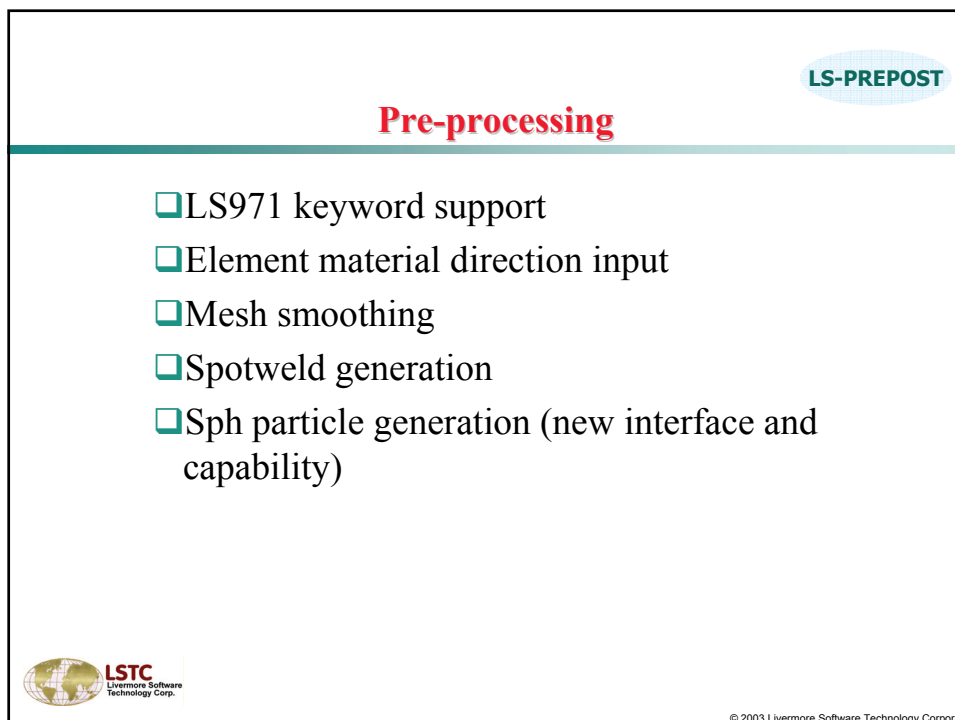
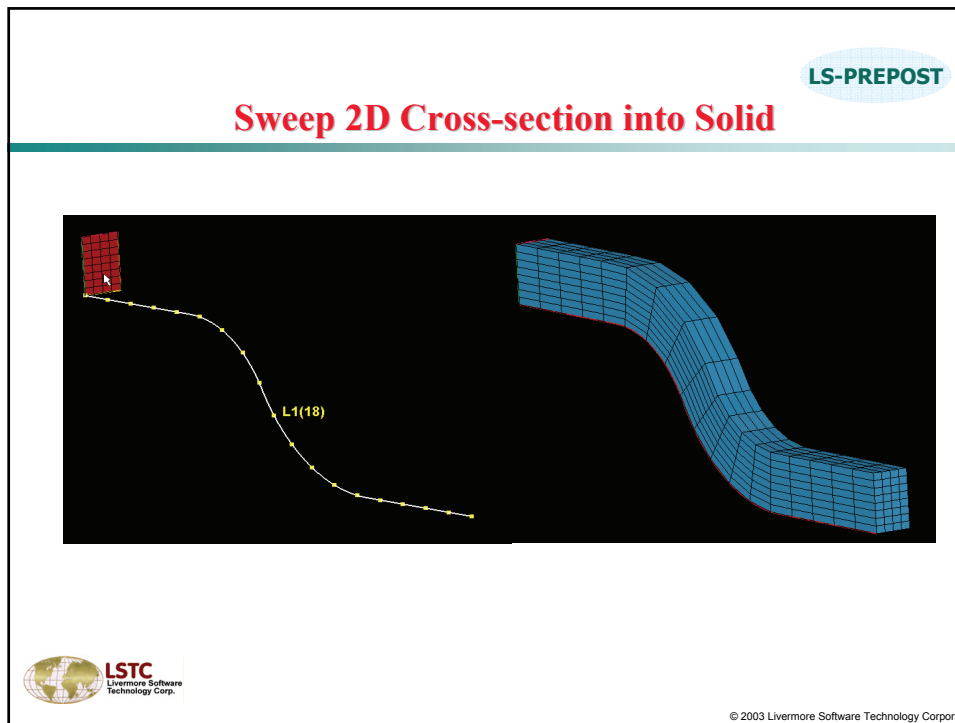
Keep Cross-section

Create

Accept Reject Done



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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



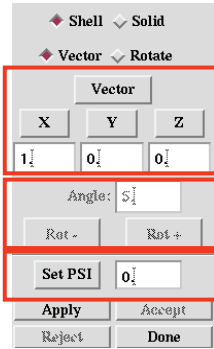

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Element Material Direction

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

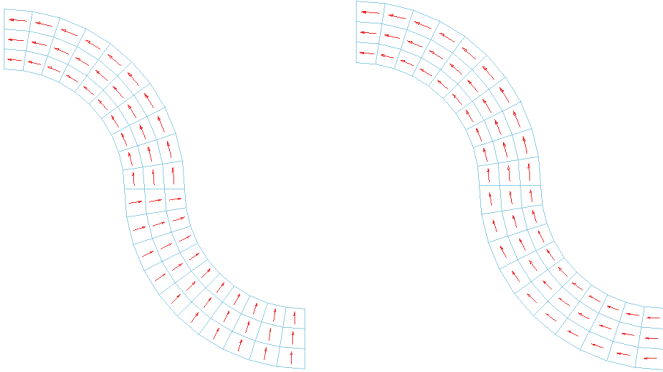
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Element Material Direction


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

Shell Solid
 Vector Rotate

A-vector

X	Y	Z
1 _i	0 _i	0 _i

D-vector


X	Y	Z
0 _i	1 _i	0 _i

Shell Solid
 Vector Rotate

Angle: 5_i

Global direction
 Local ele. axis

X	Y	Z
1 _i	0 _i	0 _i



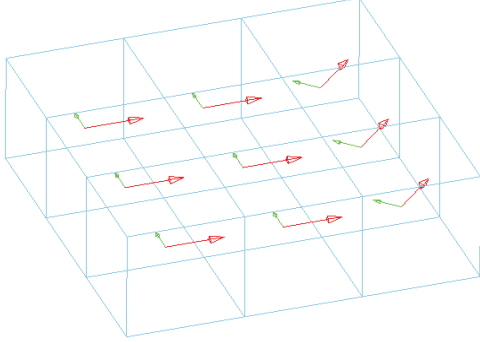
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EEdit - Direction

Solid element orientation

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





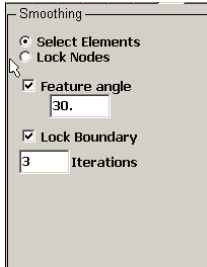
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Mesh Smoothing

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



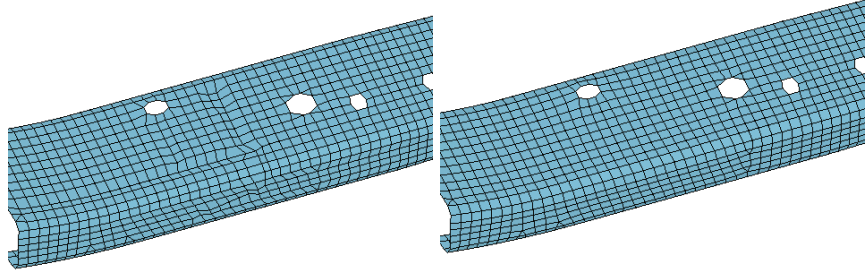


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Mesh Smoothing

Page 7 Smooth



Before smooth After smooth with locked boundary



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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

Spotweld generation

Weld File Format

Search radius:


Min Length:

Beam
 Solid

One Elem
 Four Elms

Properties:
 GUI File

Weld diameter:
 Constant
 Curve ID
 Built-in



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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

- Spotweld generation

Weld File
Format

Open
Primer

Search radius:
7.0

Min Length:
0.5

Beam
 Solid

One Elem
 Four Elems

Properties:
 GUI File

Weld diameter:
 Constant 5.0
 Curve ID
 Built-in

Create
Accept
Reject
Done

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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

- Sph generation interface

Create
 Modify

CreatedBy
PartList

PickPart

1 - sphereshell
 2 - boxshell

Pid: 4
Nid: 14658

Pitch: 15

Density: 2

Fill% 100%
100.0

Dirx
Diry
Dirz

0.0
0.0
1.0

Accept
Reject
Done

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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

Sph generation interface

Create Modify

CreatedBy: PartList

PickPart

1 - sphereshell
2 - boxshell

RemovePart

Pid: 4 Nid: 14658

Pitch: 15

Density: 2

Fill% 100% 100.0

Dir1: 0.0 Dir2: 0.0 Dir3: 1.0

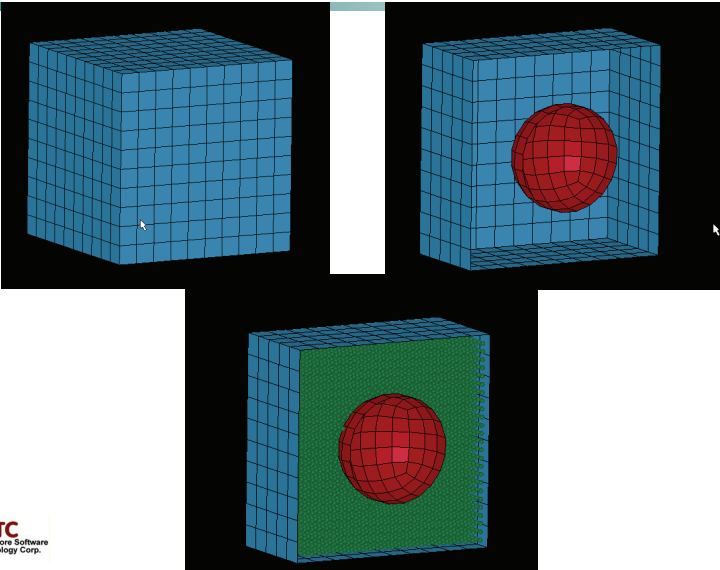
Create

Accept Reject Done

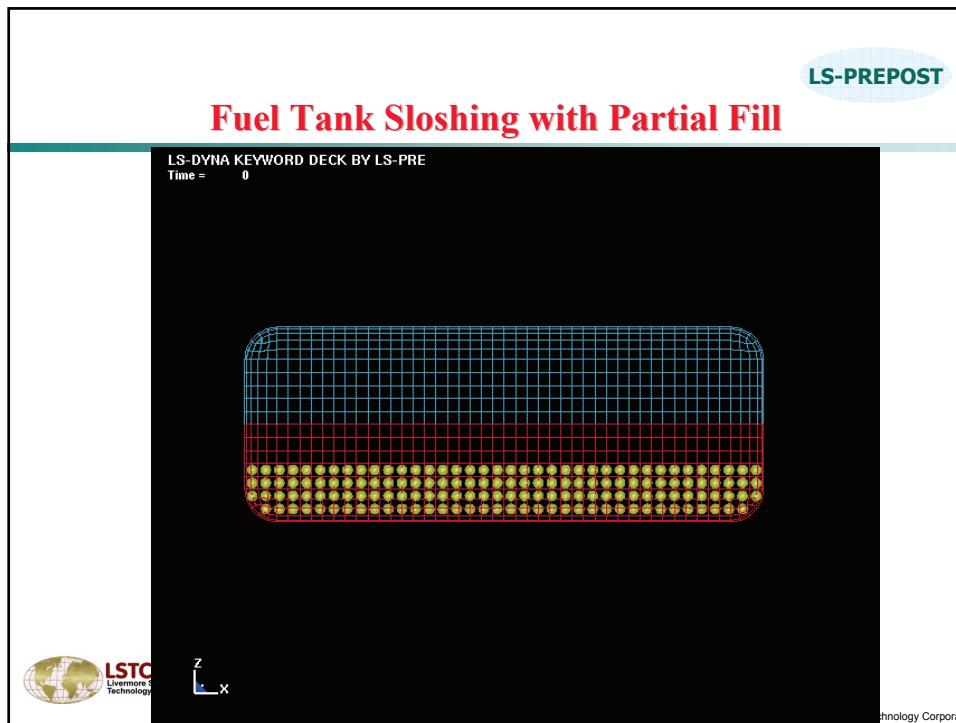
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SPH Generation



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Post-Processing

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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

Chain Multi-Models

1-LS-DYNA user input

2-SPRINGBACK ANALYSIS

Apply Remove Rem All

Total Overall States:
0

Starting State:

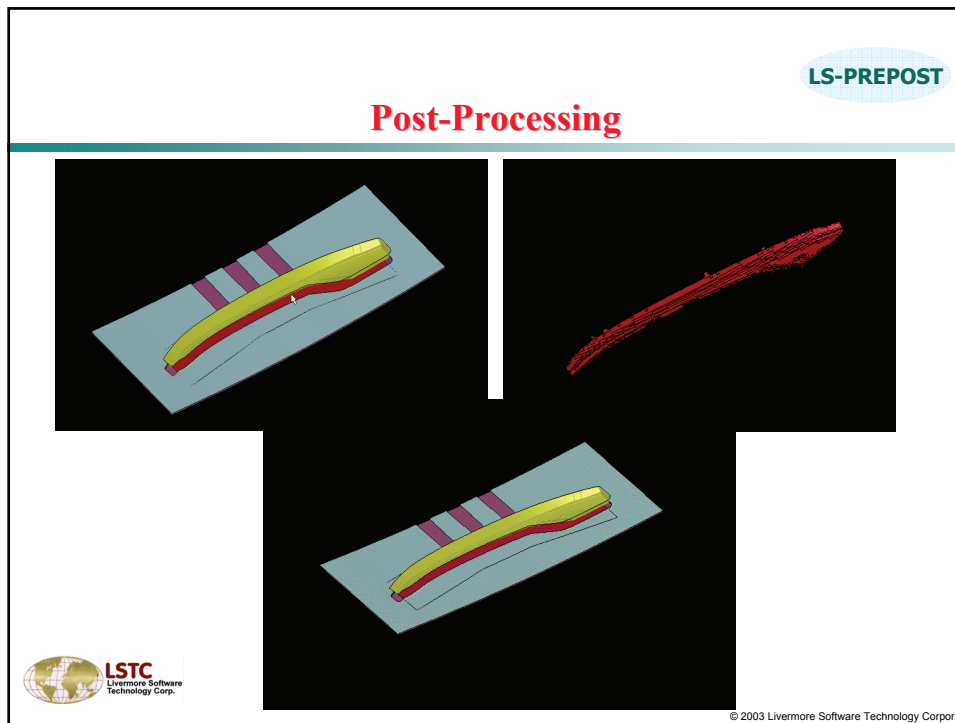
Ending State:

Increment:

Chain Unchain

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Post-Processing

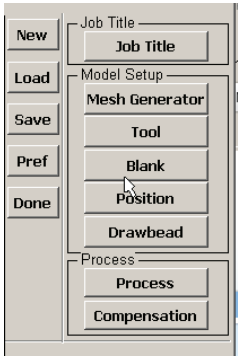
Interactive saving of post.db file

- 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 Isprepost
- 64bit post.db file can also be read in 32bit machine as long as the file is less then 2GB

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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

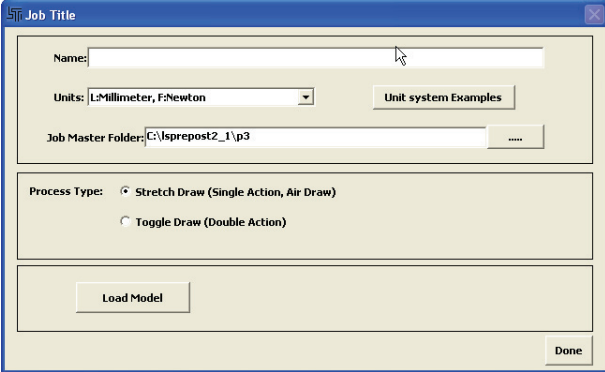



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New Metal Forming Interface

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

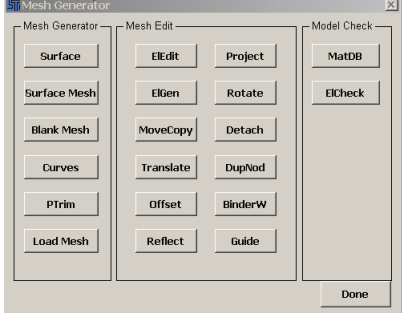




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New Metal Forming Interface



Mesh Generator – provide interfaces to various mesh creation and manipulation without going back to the main button manuals on different pages

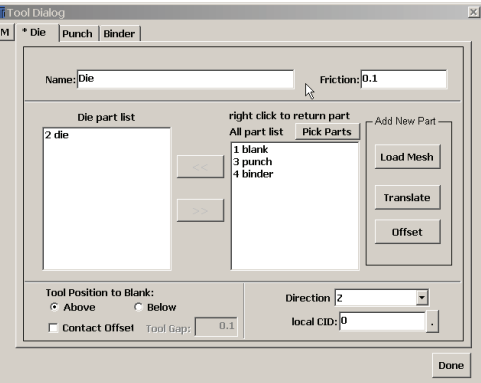
Mainly to create and edit the finite element mesh



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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

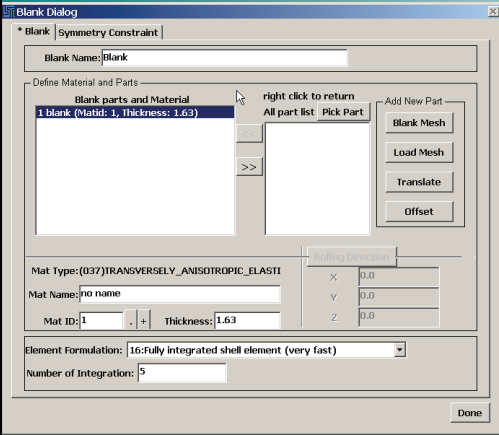
Tool position relative to the blank is also set here



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New Metal Forming Interface




Blank interface – To setup blank

Define blank material, element formulation and thickness

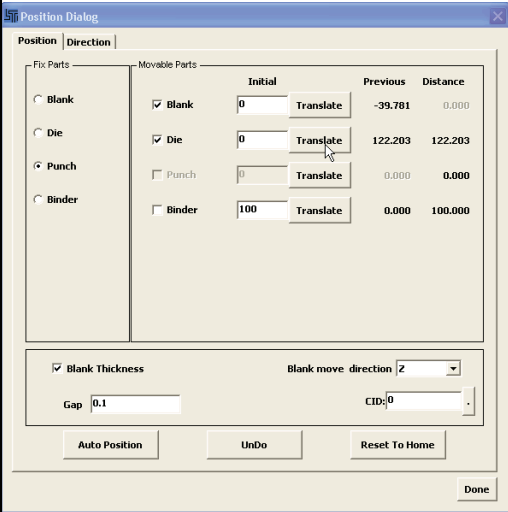
For certain material, rolling direction also can be set



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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

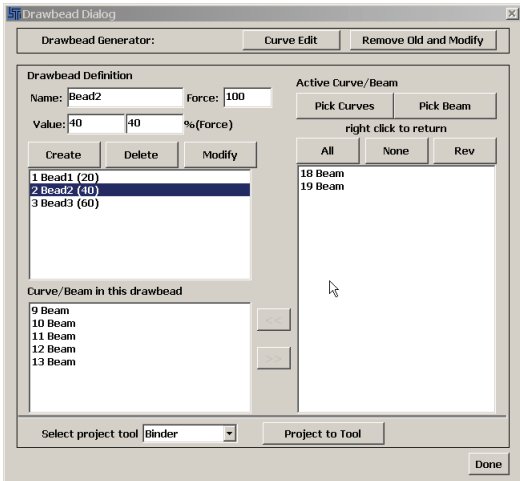
Auto Position will move parts automatically based on their positive relative to each others



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New Metal Forming Interface




The screenshot shows the 'Drawbead Dialog' window. It has a title bar with 'Drawbead Generator', 'Curve Edit', and 'Remove Old and Modify'. The main area is divided into several sections: 'Drawbead Definition' with fields for Name (Bead2), Force (100), and Value (40); 'Active Curve/Beam' with 'Pick Curves' and 'Pick Beam' buttons; a list of beads (1 Bead1 (20), 2 Bead2 (40), 3 Bead3 (60)); a list of curves/beams (9 Beam, 10 Beam, 11 Beam, 12 Beam, 13 Beam); and a 'Curve/Beam in this drawbead' section. At the bottom, there is a 'Select project tool' dropdown set to 'Binder' and a 'Project to Tool' button.

DrawBead interface – To assign curves/beams as drawbead


Define the bead force

Select tool to project to

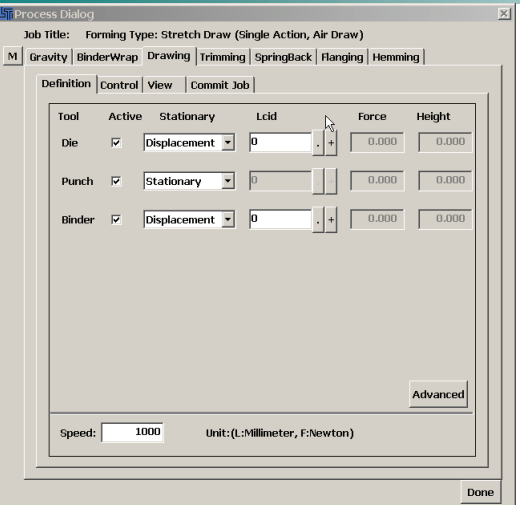
Perform projection of drawbead to Tool



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New Metal Forming Interface



The screenshot shows the 'Process Dialog' window. It has a title bar with 'Process Dialog'. The main area includes a 'Job Title' field (Forming Type: Stretch Draw (Single Action, Air Draw)), a tabbed interface with 'M Gravity', 'BinderWrap', 'Drawing', 'Trimming', 'SpringBack', 'Flanging', and 'Hemming' tabs. The 'Definition' tab is active, showing a table of process definitions:

Tool	Active	Stationary	Lcid	Force	Height
Die	<input checked="" type="checkbox"/>	Displacement	0	0.000	0.000
Punch	<input checked="" type="checkbox"/>	Stationary	0	0.000	0.000
Binder	<input checked="" type="checkbox"/>	Displacement	0	0.000	0.000


At the bottom, there is a 'Speed' field set to 1000 and a 'Unit' dropdown set to '(L:Millimeter, F:Newton)'. An 'Advanced' button is also visible.

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

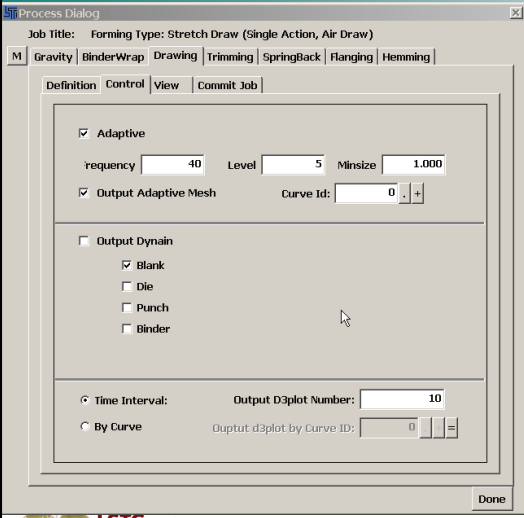
Drawing Definiton - Define if tool is stationary or displacement/velocity/force control



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New Metal Forming Interface




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

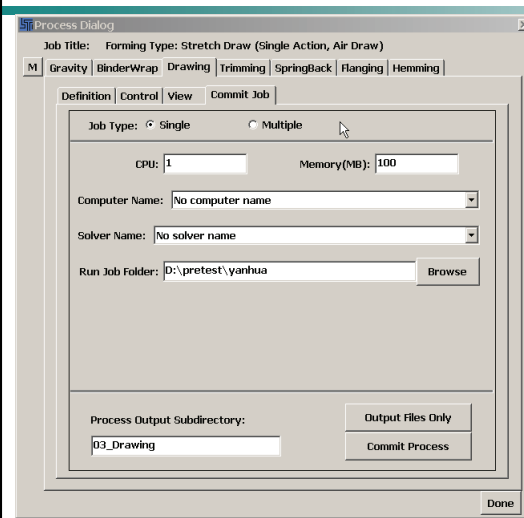
The screenshot shows the 'Control' tab of the 'Process Dialog' window. It includes the following settings:

- Adaptive: frequency 40, Level 5, Minsize 1.000
- Output Adaptive Mesh: Curve Id: 0
- Output Dynain:
 - Blank
 - Die
 - Punch
 - Binder
- Time Interval: Output D3plot Number: 10
- By Curve: Output d3plot by Curve ID: 0

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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

The screenshot shows the 'Commit Job' tab of the 'Process Dialog' window. It includes the following settings:


- Job Type: Single, Multiple
- CPU: 1, Memory(MB): 100
- Computer Name: No computer name
- Solver Name: No solver name
- Run Job Folder: D:\pretest\yanhua
- Process Output Subdirectory: 03_Drawing
- Buttons: Output Files Only, Commit Process

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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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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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