#### New Features in LS-PrePost and its Future Development

#### 11<sup>th</sup> German LS-DYNA Users Forum 2012

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### Outline of Talk

- Current status of LS-PrePost and the different releases
- New GUI of LS-Prepost 3.x/4.0
- New graphics rendering in 4.0
- Other New Features in LS-PrePost 3.2/4.0
- Current and future developments
- Summary and Conclusion



#### Version 3.2

- Is the current release of Isprepost
- Still support the old interface (version 2.4) users can toggle between old interface and new interface by F11 function key
- Tools to help users to transition from old to new interface
- Support Linux 64-bit systems, Windows 32bit and 64bits, Apple Mac OSX
- Continue to improve in stability, robustness and features
- Download: http://ftp.lstc.com/anonymous/outgoing/lsprepost/3.2



#### Beta Version 4.0

- Version 4.0 uses new rendering technique to render the finite element model results in many times faster than the older versions of LS-PrePost
- In its final testing stage before formal release in mid-November, 2012
- Requires graphics cards that support openGL version 3.3 and higher
- Enter CNTL-L twice before loading data to disable new fast rendering
- Download: http://ftp.lstc.com/anonymous/outgoing/lsprepost/4.0









### LS-PrePost 3.2/4.0 GUI





#### LS-PrePost 3.2/4.0 GUI





### LS-PrePost 3.2/4.0 GUI







- Semi transparent view control
  - Can be moved to any position on the graphics windows
  - Can be changed to smaller size
  - Beside the regular 6 views, there are iso view and cutting plane control
- Semi transparent animation control
  - Can be moved to any position on the graphics windows
  - Small foot print compare to the Animation dialog
- Both controls can be turned on and off in the "Display Options" icon





#### Configuration and Setup

- Starting from LS-PrePost version 3.2, each version has its only setting and configuration directory
- The LS-PrePost configuration file resides in the following directory:
- Windows: %AppData%\LSTC\LS-PrePost4.0
- Linux: \$HOME/LSTC/LS-PrePost4.0
- The directory contains configuration, last touch information, and recent files history



#### New Graphics Rendering in version 4.0

- Taken from a visualization research project at UCSD that was funded by Honda R&D North America (Ed Helwig)
- Part based data structure more efficient data organization
- VBO Vertex Buffer Objects reduce data communication between CPU and GPU
- GLSL OpenGL Shading Language to compute polygon normal on GPU, no need to compute normal in CPU and to store it in main memory
- Viewport Culling any part not within the viewport will not be rendered
- Sub-Part divide a very large part into sub-part to utilize viewport culling



### New Rendering Performance

- 5.65million elements (4.29m Shells, 1.36m solids, some beams, 1680 parts), 59 states
- On HP Z800 8-core, with Nvidia Quadro 6000, timing in frames/sec

	Old	New
Static Rendering	2.1	30.4
Animation 1 <sup>st</sup> loop	1.3	14.2
Avg. Animation	2.1	16.5



### New Rendering Performance

- 10.65million elements (8.44m Shells, 2.21m solids, 5223 beams, 816 parts), 49 states
- Spot weld beam was drawn as circle
- On HP Z800 8-core, with Nvidia Quadro 6000, timing in frames/sec

	Old	New	Speed up
Static Rendering	1.2	22.1	18
Animation 1 <sup>st</sup> loop	0.4	10.2	
Avg Animation loop	1.25	10.5	8.4



#### User group and Online Documentation

- User Group more than 2200 members as of May, 2012
  - <u>http://groups.google.com/group/ls-prepost</u>
- Documentation and tutorials can be accessed from the pull down HELP menu

	SPrePost 3.2 Help Document	
	Hide Back Forward Home Qotions	
4bit	Conterns Index Model Overview	<u>^</u>
cation Settings Help	Bert Tonbar     Select which parts and assembly to display, delete .     Assembly and Selpart - Select which parts and assembly to display, delete .	
Documentation	Bottom Toobar     Geometry     Keyword Manager - providing access to keyword editing and search interface.	8
Tutorial	Create Entity - Generate entities, and also allow the user to use the drawing area visualize entities while working on them.	a to
Old to New	Display Entity - Display LS-DYNA entities such as sets, contacts, rigidwalls,bo     De General Tools     Application	oundary,
Release Notes	Command     RefCheck - Identify unreferenced, undefined, or attached entities.	
Check for Update	<u>Renumber</u> - Renumber IDs of model entities.	
About LS-PrePost	Section Plane - Create cross sections of the model.	=
	Model Selection - Open and select multiple models.	
	Subsystem - Interact with an manage sub-systems.	
	Group - Create and manipulate groups of parts.	
	<u>View</u> -Save and retrieve appearance, color, and orientation settings.	
	Part Color - Apply different colors and transparency levels to selected parts.	
	<u>Appear</u> - Change the appearance of selected parts.	
	Annotation - Add annotations to a model.	
	Split Window - Split graphics region into multi-view.	
	Explode - Explode/separate parts so that they can be viewed more easily.	
	Light - Apply effects using up to ten independent light sources.	-

# Other new features and improvements in LS-PrePost3.2/4.0



#### Batch mode Operation – (-nographics)

- Batch mode operation with full graphics capability using LS-Prepost
- Run Isprepost 3.2 with command file and use -nographics
- Works very well on PC/Windows platforms
- Has limitations on Linux platforms:
  - Machine to run Isprepost with –nographics must have OpenGL and X capability
  - Local machine that remote logs into to the remote machine also must have OpenGL and X capability
  - If the above conditions not met, use the Linux virtual frame buffer (Xvfb) for batch mode:
    - Xvfb :2 -screen 0 1074x800x24



#### LS-PREPOST Features for LS-980

- Support for Multi-physics keywords: \*CESE, \*ICFD and \*EM
- Multi-physics keyword files can be displayed and edited
- Models can be a mixture of Multi-physics and Mechanical meshes
- ICFD modeling can be 2D or 3D with mesh adaption (re-meshing)
- Support for ICFD LevelSet functions



#### LS-PREPOST Features for LS-980

- LS-980 output is an extension to the standard d3plot. LS-PrePost recognized that Multi-Solver output data is presented in the files and is flagged to read the data according to which Multi-physics is found.
- Each solver has a different format and different output variables. These can be scalar or vector quantities



#### LS-PREPOST Features for LS-980

- Output fringes are available via the Fcomp menu and Extend button. If the model contains mechanical parts the standard buttons are used like Stress, Ndv, etc.
- Streamline for Multi-Solver vectors via the Trace menu and the Streamline button.
- Section plane vectors.
- Stochastic particles.



#### Fringe plots as Iso-surface



Display model in feature lines mode

#### Streamlines of velocity



#### Section plane velocity vectors



#### Iso-surface, s-plane vectors, and streamlines

<u>File Misc. View Geometry FEM Application Settings H</u>elp



#### Stochastic particle fringe and velocity vector

<u>File Misc. View Geometry FEM Application Settings H</u>elp

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## CESE with stochastic particles, fringe by size with velocity vectors



#### Levelset surface is invoked in the SelPar menu only if the data is in the d3plot, and can be manipulated like a part.





#### Fuel Tank Fluid Surface shown by Levelset part. Levelset can be fringed with CFD variables, and with velocity vectors on the surface





#### New XYPLOT layout

Vistory

Global

Nodal

) Int Pt

Element

Sum Mats

Total Coordinate X-displacement Y-displacement Z-displacement Resultant Displacement

Resultant Velocity X-acceleration

Elm

Any

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X-coordinate Y-coordinate Z-coordinate

X-velocity Y-velocity

Value:

E-Type:

E-Axes:

5urfac

Popup

Plot

Clear

STC

Part
R-Nodal

Scalar

Vol Fail
Along Path

 New XY plot interface allows xy plots to be drawn to main graphics windows, or to a separate page with multiple plots per page

Select "Popup" for the old XY plot interface

Select "Main" to activate new XY plot interface

"New" button will plot the xy data in the new port, if the page is full, then new page will be created automatically



In the bottom toolbar, this icon to activate page control

#### LS-PREPOST 3.0(Beta) - 10Mar2010(14:03) C:\posttest\bag1\d3plot \_ 🗆 🗙 File Misc. View Geometry FEM Application Settings Help (+ 8 FriComp RefGeo STEERING WHEEL MODEL WITH PACKED 18-FOL STEERING WHEEL MODEL WITH PACKED 18-FOL 0.2 0.05 1 25 Node no. Node no. FriRang Curve Y-displacement-339 X-displacement-3392 -0.15 History Surf y X-displacement Y-displacement 0 0.1 XYPlot Solid Angl -0.05 14 ASCII GeoTo 0.05 and one 徧 -0.1 Binout Mesh A -Follow Model -0.05 5 -0.15 -0.005 0.01 0.015 0.02 0.025 0.03 0.035 0.005 0.01 0.015 0.02 0.025 0.03 0.035 b b Trace EleTol Time Time É, State Post -Particle STEERING WHEEL MODEL WITH PACKED 18-FOL STEERING WHEEL MODEL WITH PACKED 18-FOL Favor1 0.4 0.4 Node no. Node no. CGrid 201 Z-displacement-3392 **Resultant Displacement-339** 0.3 ChaiMd Resultant Displacement 0.3 \* Z-displacement FLD 0.2 0.2 Output 0.1 ? Setting 0.1 lv Vector -0.1 0.01 0.015 0.02 0.025 0.03 0.005 0.01 0.015 0.02 0.025 0.03 0.035 0.005 0.035 b Time Time 🕲 🌚 🖓 🌚 🗇 🖓 🌐 🍘 🏶 🧇 • U\_\* 😭 🥃 💱 🔣 🏹 🖸 🙆 💮 💮 💮 🖓 🗸 🖉 🌘 🕲 🖓 🌾 🚱 subcanvasplot showcurrent page Clear highlighted or picked entities

Livermore Software Technology Corp.

XY graph icon to switch back





Show Port/Show Pages to toggle between main window and plot window pages

Save/Load buttons to save plots into a file and can be loaded back into Isprepost in another session

#### New Movie Formats

- .gif Graphics Interchange Format
- .avi Audio Video Interlaced
- .wmv Windows Media Video
- .mov Apple Quick Time Movie
- Both .wmv and .mov format are small in size, but not good quality
- 24bit .avi gives the best quality but very big in size

Movie [	Dialog 🗾 🚬	
Format	wmv/wmv 👻	
Use	GIF	
Size	MOV/MPEG4	
Window	WMV/WMV AVT/RLF	
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Gamma(	(0.5-2.0)dark-light	
1.0		
	Start Cancel	



### Fringing by Script

- In the fringe expression interface, use script (a programming code) instead of an expression
- Assign components to variables
- User writes the script (code) to perform whatever data manipulation to get final result

Check this box

for using script



Thickness Strain

Forming



## Fringing by Script

• Example of the script, it is a formatted ascii file

```
/* a = some stress value b = %ThicknessReduction */
define:
Float MyExpressFunc(Float a, Float b)
    Float ret = 0.0;
    if (a < 0 \&\& b > 0.2)
      ret = 3.0;
    }else if ( a >= 0 && a < 0.05 && b > 0.22)
      ret = 2.0;
    }else if ( a >= 0.05 && b > 0.25)
      ret = 1.0;
    return ret;
```





### Model Chaining

- To chain multiple sets of post-processing result into one continuous animation
- Read in as many d3plot file sets as need to be chained, each will be a separated model
- Set drawing primitives like transparency, drawing mode, etc. for each individual model
- Go to Post->ChaiMd, select the model from the list and click Apply
- After selecting all models, click "Chain" to apply chaining, then animate
- This is not a new feature, but was not introduced in the past




#### Model Compare for Post-Processing

- Read in 2 sets of d3plot files
- Model should be similar
- Go to Post->MSelect, and select 1<sup>st</sup> and 2<sup>nd</sup> model for comparison
- Click "Compare" and wait for the data processing (will take time depends on model size)
- Compare will show different data in the following categories:
  - Summary
  - Global
  - Displacement
  - Stress
  - Strain





#### Model Compare for Post-Processing

- Summary basic model information
- Global global energy results
- Displacement the 3 global min/max values of displacement with node IDs
- Stress the six global min/max stress • values with element IDs
- Strain the size global min/max strain values with element IDs

	Displacemen	nt Stress	Strain	Misc	
		Mode	l-1	Mode	el-2
Max ti	me	0.149100		0.149100	
No. of st	ates	17		16	
Total No. o	fnodes	167806		167806	
Total No. o	fparts	50		50	
No. of bean	n parts	0		0	
No. of shel	l parts	50		50	
No. of solid	l parts	0		0	
No. of tshe	ll parts	0		0	
No. of sph	parts	0		0	
No. of bean	n elems	0		0	
No. of shell	elems	167447		167447	
No. of solid	elems	0		0	
No. of tshe	l elems	0		0	
No. of sph	elems	0		0	
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Extent n	ахх	151338.84	13750	169022.4	06250
Extent r	niny	-193675.0	00000	-193675.0	000000
Extent n	naxy	219075.00	0000	219075.0	00000
Extent r	ninz	-86000.00	0000	-86000.00	00000
Extent n	naxz	142600.00	00000	142600.0	00000
Deleted e	lems	0		0	
No. global v	ariables	356		356	
Nv2d	ł	0		0	
Nv3d		0		0	

state 10:time 0.089100

Done

state 10:time 0.079100

te 11:time 0.089100



D3plot Models Compare								
Summary Global Displacement Stress Strain Misc								
	Model-1(Value)	Model-2(Value)	Model-2(Part)	Model-2(Item)				
x-displacement min	2002.7	1	N66162	19696.3	1	N157713		
x-displacement max	2519.2	1	N72301	24408.1	1	N72301		
y-displacement min	-298.821	1	N98280	-868.625	1	N39071		
y-displacement max	115.359	1	N72296	989.434	1	N11957		
z-displacement min	-349.383	1	N63693	-872.531	1	N70856		
z-displacement max	327	1	N95485	1925.96	1	N32235		
,								

#### Displacement value compare table

3plot Mo	dels Com	pare	1						_
Summary	Global	Displacement	Stress	Strain	Misc				
			Model-1	(Value)	Model-1(Part)	Model-1(Item)	Model-2(Value)	Model-2(Part)	Model-2(Item)
х	-stress r	nin	-4.88605	e+011	44	S97584	-5.07636e+011	32	S70473
x	-stress n	nax	5.26891e	+011	32	S70359	4.61351e+011	8	S16143
У	/-stress r	nin	-3.85562	e+011	29	S70844	-6.62668e+011	13	S36069
У	-stress n	nax	6.37134e	+011	32	S70353	6.657e+011	9	S25514
2	z-stress r	nin	-5.14827	e+011	29	S70906	-6.65736e+011	9	S27028
z	-stress n	nax	5.20831e	+011	29	S70937	6.87303e+011	13	S36064
х	y-stress	min	-3.35629	e+011	32	S70352	-2.26296e+011	32	S70358
x	y-stress	max	3.2788e+	-011	32	S70359	2.87103e+011	12	S25308
y.	z-stress	min	-2.497e+	011	41	S97952	-3.21899e+011	9	S25547
y2	z-stress i	max	2.93272e	+011	29	S72085	3.1249e+011	13	S36066
z	x-stress	min	-3.22076	e+011	29	S71899	-2.27891e+011	41	S99099
Z	c-stress i	max	3.01729e	+011	41	S98076	2.63092e+011	5	S16722
von n	nises str	ess min	0		51	S108433	0	51	S108433
von n	nises stre	ess max	6e+011		32	S70353	6e+011	13	S34548



#### Stress value compare table

### D3HSP file viewing

- d3hsp file contains a lot of information for the LS-DYNA run
- LS-PrePost reads the information from this file and organizes them into a tree/list structure for easy reading
- Key phase search is possible
- Launch d3hsp view in Misc pulldown menu
- Only available in version 4.0 and later



#### d3hsp file viewing



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 Common boundary lines between two surfaces can be suppressed to form a joint surface, this will allow mesh across boundary lines to give a better mesh



Boundary lines not suppressed



• Auto meshing after boundary lines suppressed



Boundary lines suppressed



Heal Model	23
Heal Type C Face O Vertex C	Edge Hole
<ul> <li>Toggle</li> <li>Replace</li> <li>Break</li> <li>Suppress</li> </ul>	Untoggle Small Edges Duplicate
Edge List	
Suppress Angle	

- To suppress a boundary line on the surface: go to GeomTool->Heal, select Edge, and then select Suppress
- Click boundary lines to highlight, then click Apply
- Suppressed boundary lines will be drawn in dash form



	Auto Mesher
88888	Mesh Mode Size  Deviation
	Mesh Type Mixed  Elem Size 0,12 Compute Reset
	Mesh across suppressed edges Show Meshed Boundaries Auto remesh boundary Manual remesh boundary Mesh By GPart
	Ignored Hole Size 0 Merge Tolerance 0
	Mesh Reject Accept

 To mesh surface with suppressed line, go to Auto mesher, enter size and check "Mesh across suppressed edges"



#### Solid Meshing with Hex Element

Solid meshing by blocks - using cut and dice method and then sweeping





# Metal Forming Application

App	lication Settings Help		_		
<u>8</u>	Airbag Folding		Γ		
<u>~</u>	Dummy Positioning		Ŀ		
2	Seatbelt Fitting		16	ARAR	
F	Metal Forming	×		Easy Setup	Ctrl+Q
цţ	ALE Setup			General Setup Roller Hemming	Ctrl+H
V.	Model Checking	•		Scrap Trim Simulation	n
<b>#</b>	Intrusion Measurements		Г		
P	Head Impact Positioning		Ŀ		
羅	Granular Flow Setup		Ŀ		
<b>N</b>	Airbag Impact Setup				

Metal Forming Graphics User Interface (GUI) is designed to ease the setup of a stamping simulation input data using LS-DYNA.

- Easy Setup
- General Setup
- Roller Hemming
- Scrap Trim Simulation Setup





# Metal Forming $\rightarrow$ eZsetup



- Standard draw type
- Step-by-step tool definition
- Easy draw bead modeling
- Automatic tooling position
- Multiple processes
- User control options



### $eZsetup \rightarrow Tool definition$





#### eZsetup →Blank definition

Blank info setup	Die	Binder	Punch	Blank	Drawbea 🛃 🕨
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#### eZsetup →Drawbead modeling



Metal Forming eZsetup Wizard					
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	Show Show	) Drawbead Lo ) Drawbeads ) Curve Label	ckage		
		*righ	t click finish	the picking	
✓ AutoHide			Back	Next	Close



#### eZsetup →Processes control

Metal Forming eZsetup Wizard		Metal Forming eZsetup Wizard			
Metal Forming eZsetup Wizard           Database control info setup         Punch         Blank           Forming Trimm         Forming cont           Image: Setup definition of the setup         Image: Setup definition of the setup	Drawbead       Control       Submit       Image: SpringBack         rol option       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         ior early feasibility       ior early feasibility       ior early feasibility         Selective Mass Scaling(SMS)       Show Parameters       Metal Forming eZsetup Wizard         Metal Forming eZsetup Wizard       Punc       Fo	Metal Forming eZsetup Wizard	Punch       Blank       Drawbead       Control       Submit       4         Forming       Trimming       SpringBack         SpringBack control option       Constrains:       X       Y       Z       Pick Constraint Location         V       V       V       Constrained Location:       -287.903,-2.72783,81.9094 (1,1,1)       -94.5954,54.5516,94.1763 (0,1,1)       -135.028,-45.657,92.2734 (0,0,1)         Modify       Remove       *right dick finish the picking		
AutoHide	AutoHide	Trimming control option       ① 2-D     ③ 3-D       Trim curves     Seed Location       *right dick finish the picking         Back     Next	Back Next Close		



### $eZsetup \rightarrow LSDyna job submit$

Metal Forming eZsetup Wizard						
Job Submit	Blank D	rawbead Control	Submit	• •		
	LS-Dyna Job	Submit		147		
	File Folder:	C:\forming_test\EZsetup_dem Browse				
	File Name:	LSDyna_input.k				
V AutoHide		Bad	k Outpu	t Close		



# **Roller Hemming Setup**

- To setup for Hemming simulation
- Starting with model mesh and roller mesh
- Define roller orientation and traveling path
- Define flange parts and inner part
- Define contact information between rollers and flange parts
- A complete LS-DYNA keyword input file will be setup ready to run hemming simulation



#### **Roller Hemming Setup**

ller Hemming F	Process					×	Use + button to
b title: Isrhm					R	toller	_add as many roller
Tool/Path G	Gen Part Definition	Simulate				Job Setup	as needed
Roller 1	Roller 2					New Job Job Info	]
Part ID Name		16 .	Pick		Roller 1		Roller definition and traveling path
Curve #1 ID	3	Pick (	Reverse	Translate	Blank		defined by curves
Roller Rotation	n Control		Rotation				
Radius	7.14		x	0.0			Roller orientation
Extra Gap	0		z	90			
Oisplacement	ent						
Force	Force		0 Direction	Hem Normal	*		
Roller Travel S	Speed	2000 Rolle	r Spin Speed		2000		
				Roller path ir	nput file		
						Done	

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### **Roller Hemming Setup**

Roller Hemming Process	×	Lleo , button to	
Job title: Isrhm	Flange	add as flange par	
Tool/Path Gen Part Definition Simulate	Job Setup		
Flange 1 OuterMain Inner 1 Hem Bed	New Job		
Part ID 1			
Part Name Flange1			
MatID 1 . + MD Thickness 0.762		Flange part	
Name no name		definition	
Type (037)TRANSVERSELY_ANISOTROPIC_ELASTIC_PLASTIC			
Formulation #1 ID 16:Fully integrated shell element (very fast)	•		
Number of integration 7			
Define contact of flange <<			
Contact with Roller List		]	
16 Roller 1           36 Roller 2           <<		Contact definition	
Define non-adaptive areas >>	Done		







# Scrap Trim Simulation Setup

- To setup for LS-DYNA scrap trimming simulation
- Define scraps
- Define trim tools, trim direction, trim velocity and retract velocity
- Define lower tools that will obstruct the scrap fall
- Define contact relationship between all tools



# Scrap Trim Simulation Setup

NARARARA.		
8	Scrap trim simulation	
_A	Scrap Trim Steels Lower Tools Submit	
3	Scrant Scran2 Scrap3	
	Scrap Part: 11 Pick Part	1
55 T	Material: 1 . + MD	
	Thickness: 1	
pid=11		
	Delete	
		4



### Scrap Trim Simulation Setup

Gcrap trim simulation		×	Scrap trim simulation	X
Scrap Trim Steels Lov	wer Tools Submit		Scrap Trim Steels Lower Tools Submit	
		+		+
TS1 TS2 TS3			LT1 LT2 LT3 LT4 LT5 LT6	
TS Part ID:	14 Pick Part		LT part ID: 20 Pick part	
Trim edge NDSET:	7771 Select Create		Scrap1	
Trim direction:	Select Create		Contact with:	
Trim velocity:	2000 distance:	30	· Staps	
Retract velocity:	3000 distance:	40		
Wall part ID:	Pick Part			
	Scrap1			
Contact with:	Scrap3			
	D	elete		Delete



# Scrap Trim Setup



#### **DynFold Application**

- Dynfold is designed to prepare input files for simulation based airbag folding process. Typical physical airbag folding process is done in 4 to 5 steps (runs of LS-DYNA).
- Dynfold user interface is designed to setup one step at a time. Often the deformed shape at the end of one folding step is used as a starting mesh for the next step.
- The airbag model is expected to have nodes, elements, part, section and material defined before using this interface.
- The physical folding process is generally of the following form:

   a. hold the bag in position while being folded
   b. clamp a portion of the bag to a folding tool
   c. Apply motion to the tool in translational direction or rotational direction or combination of both.
- At present 4 folding tools are supported: Loadmesh, SPC, BPMF(BOX), Stitching and Tuck



#### **DynFold Setup Process**

- Define Parameters: Define Project Step Name, Termination time, airbag tool Material Parameters.
- Load Airbag: Load finite element mesh, Position airbag by translate, rotation, etc.; show airbag, or turn off show.
- Define Airbag Folding Tools, currently there are four kinds of tools
  - Load meshing:
    - Load tool meshing file; Define tool attaching to bag.
    - Define Load Meshing Tools Motion.
    - Preview tool motion (Home position and Final position)
  - Spc\_Birth\_Death, BPMF(Box), Stitch



- Spc\_Birth\_Death, BPMF(Box), Stitch
  - Define boundary spc node set.
  - Define Constrained
  - Define Birth and Death time.
- BPMF(Box)
  - Define Original and Final position of the Box.
  - Define contact between box and airbag parameters .
  - preview of Original/Target position of the box in graphics view .
- Stitch
  - Define Stitch parts and parameters.
  - Define Get stitch start position and direction.
  - Define stitch Birth and Death time





Define part Motion with motion property





Preview tool motion Home position(left) and Final position (right)



Process Airban Tools		
BPMF1 - Contact between tool - Death: 1e+010 - Birth: 0	Tool Motion	New
	Type: BPMF(BOX) - AddTool	Output
	Name: BPMF1	Run Dyna
NX: 10; NY: 10; NZ:	Contact between tool and airbag:	
- Gap: 100	Death: 1.0E+10 Birth: 0.0 Thick: 1.0	
Pr: 0.3	NX: 10 NY: 10 NZ: 10	
Original Min Position	GAP: 100.0 Emod: 2.0 PR: 0.3	
- Target Min Position:	Original Position:	
Target Max Position	Min: -430, -430, -134.5 Position	
	Max: 430, 430, 101 Position	
	Show Original Position Apply Pos	
	Target Position:	
	Min: -220.888, -201.737, -44.4825 Position	
	Max: 235.01, 230.376, 68.2468 Position	
	Show Final Position Apply Pos	
۰ الله	ModifyTool	Done

Tool BPMF(Box): define Original and Final position of the Box





Define and Preview tool box original position and target position





#### \*Airbag\_shell\_reference\_geometry

- \*Airbag\_shell\_reference\_geometry is the required data for airbag deployment in LS-DYNA
- LS-Prepost creates this data by asking user to pick the parts that make up the airbag in 3D final configuration and unrolled them into 2D flat panels.
- Element IDs are preserved with new nodal coordinates



#### \*Airbag\_shell\_reference\_geometry




# Part Replace

- Model->PartD->Replace
- To replace a part with another part
- The 2 parts do not need to be the same in no. of elements/nodes.
- Connection between others part will be done automatically when it is possible







#### Other Miscellaneous Improvements

- Many bugs have been fixed in geometry engine
- Improved mid-surface generation from solid model
- More robust trimming and solid cutting
- Improved automatic solid meshing
- More robust LS-DYNA model checking with auto fixing
- Particle, temperature post-processing data and multiple models support in FEMZIP format
- Solid element and seatbelt element splitting
- Element edit with check, locate and repair



# Current and Future Developments in LS-PrePost



# User written script for repetitive operations

- C-like programming scripting language to execute LS-PrePost commands
- Allows "if then else", for, and while loop operations
- Uses LS-PrePost DataCenter to extract model data: like no. of parts, part ID, no. of elements, no. of nodes, etc.
- Extracted data can be used as variables to perform operations
- Most suitable to perform the same operations over different part of the model



#### User written script

/\*LS-SCRIPT:PartId repeat cmd\*/

DataCenter dc;

Sample script to extract no. of parts and all part IDs, then draw each individual part and print it to a file with the part id as file name

```
Int partnum, *ids;
define:
void main(void)
Int i = 0;
char buf[256];
Int modelld:
modelId = GetCurrentModelID();
DataImportFrom(&dc,modelId);
partnum = DataGetValidPartIdList(&dc,&ids);
for(i = 0; i < partnum; i = i+1)
{
sprintf(buf,"m %d",ids[i]);
ExecuteCommand(buf);
ExecuteCommand("ac");
sprintf(buf,"print png part_%d.png LANDSCAPE nocompress gamma 1.000
    opaque enlisted \"OGL1x1\"", ids[i]);
ExecuteCommand(buf);
}
free(ids);
} main();
```



#### Metal Forming - Die System Module

• Complete metal forming Die design system

2012(	11:34)-	-64bit		Concernence of States											
FEM	App Sh	Airbag Folding		Di	Die System Module									X	
		Dummy Positioning				Preparation	Tipping	Unfolding	Binder	P.O.	Addendum	Output			
18	3	Seatbelt Fitting				Prepare				i i	Part Define				
	2 2 2	Metal Forming	Easy Setup General Setup Die System Module	Ctrl+Q			Import			Shell Part 1 : Working Part Shell Part 4 : Working Part					
		Roller Hemming					Middle	Middle Surface							
	Ц	ALE Setup					Surface Mesh								
	V	Model Checking	•				Model Ch	neck/Repair							
	IHS 0	Intrusion Measurements					Fill In	ner Hole							
													[	Add to DSI	dof M
											<u>.</u>				Done



#### Metal Forming - Die System Module

- Provides a user friendly interface to design the complete tooling system
  - Starting from CAD geometry
  - Tipping: make sure that the part can be made without undercut
    - Many options are available to allow user to check and position the part with a desired orientation
  - Binder design is fully parametric
    - User can easily manipulate the binder surface
  - Addendum design obtain a smooth surface that is tangent to both the tool part and the binder
    - To make sure that the part can be deformed correctly
    - Parametric patch method will be employed
  - Initial blank size estimation one step solver



#### Other Current Developments

- Multiple section cuts
- Section cuts for particle elements (SPH, CPM, Discrete elements)
- Section cuts for CFD data



# Summary

- New GUI provides better look and feel, also yields maximum windows space for graphics, at the same time old interface is still available to user
- Capabilities in the geometry engine allows CAD data to be modified and repaired before meshing and therefore eliminate tedious mesh modification
- New rendering in Version 4.0 employs the latest rendering techniques in OpenGL, speeds up the rendering by many times, viewing and animation of very large models now is possible
- LS-DYNA model data check is a very important tool to ensure the validity of the data before running LS-DYNA
- Scripting language will be further developed to provide much more powerful capability



### Conclusion

- LSTC is committed to continue to develop and enhance LS-Prepost by improving its stability, robustness and user friendliness
- New features have been added continuously to keep up with the development of LS-DYNA both in the post-processing and pre-processing
- New Applications have been implemented to let user do special LSDYNA job setup easily and quickly
- Users' feedback and suggestions are always welcome

