

New Features of LS-PrePost 3.0

Philip Ho

LSTC

Summary:

The introduction of the new LS-PrePost 3.0 will be presented here. A completely redesigned graphical user interface has been implemented in the new version of LS-PrePost 3.0. Tool bars and icons are being used for the main manual system to replace the old text based button system. The icons can be set to have text or without text. The new interface provides the maximum possible graphical area for the model rendering at the same time allow users to define their own toolbar with frequently used icons put together as they like. Besides using icons from the toolbars, a pull down manual system can also be used to reach to the function interfaces. Popup windows are used for each functional operation. Only one functional operational will be active at one time. Users can easily switch between the old and new interfaces if they do not feel comfortable in using the new interface. Also, an old to new interface button system has been implemented to transition users from the old interface to the new interface. Another major feature in LS-PrePost 3.0 is the newly developed geometry processing engine. The geometry processing engine is based on Open Cascade Technology 6.3. LS-PrePost 3.0 supports basic geometry entities such as lines, surfaces, and solids. It supports shape fixing and reshaping, such as fixing hole, small edge removal, vertex reposition and deletion, small face removal or face extension. It also supports faces stitching to provide better meshing result in the auto mesher. Geometry data can be imported via Iges or Step file format, while modified geometry also can be exported in iges file format. Surfaces can also be created from existing mesh using LSTC's own reverse engineering module.

Beside the new interface and geometry processing engine. New applications have been added to the LS-PrePost3.0 such as the Roller Hemming job setup and the LS-DYNA ALE job setup. An application frame work has been created such that new applications can be easily added in the future.

New Features of LS-PrePost 3.0®

7th European LS-DYNA Conference

Salzburg

Philip Ho

May 14, 2009



1

Outline of talk

- Introduction
- New GUI in version 3.0
- Geometry Engine in version 3.0
- New Applications
 - Roller Hemming setup
 - ALE setup
- Outlook



2

Introduction

- LS - PrePost is an advanced pre and post - processor that is delivered free with LS - DYNA
- Core Functionality
 - Full support of LS - DYNA keyword files
 - Full support of LS - DYNA results files
 - Post - processing (animations, fringing, curve plotting, etc...)
 - Pre - processing (meshing, clean up, entity creation)
- Online Resources
 - Official Website: <http://www.lstc.com/lsp>
 - User Group: <http://groups.google.com/group/lsp-prepost>



3

Current Status of LS-PrePost

- LS-Prepost 2.4 is the current release
 - Download:
<http://ftp.lstc.com/anonymous/outgoing/lsprepost/2.4>
 - Available for all Unix, Linux and windows
- LS-PrePost 3.0 is available for Alpha testing
 - Download:
<http://ftp.lstc.com/anonymous/outgoing/lsprepost/3.0>
 - Version 3.0 only available for Windows 32bit, 64bits and Linux 64bit



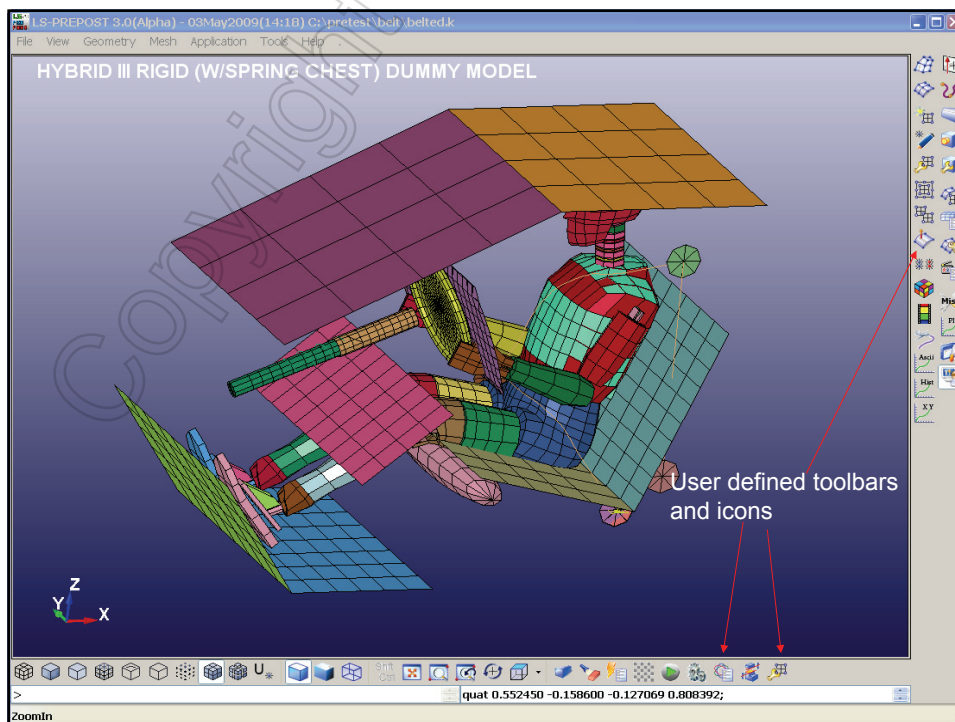
4

LS-PrePost 3.0 GUI

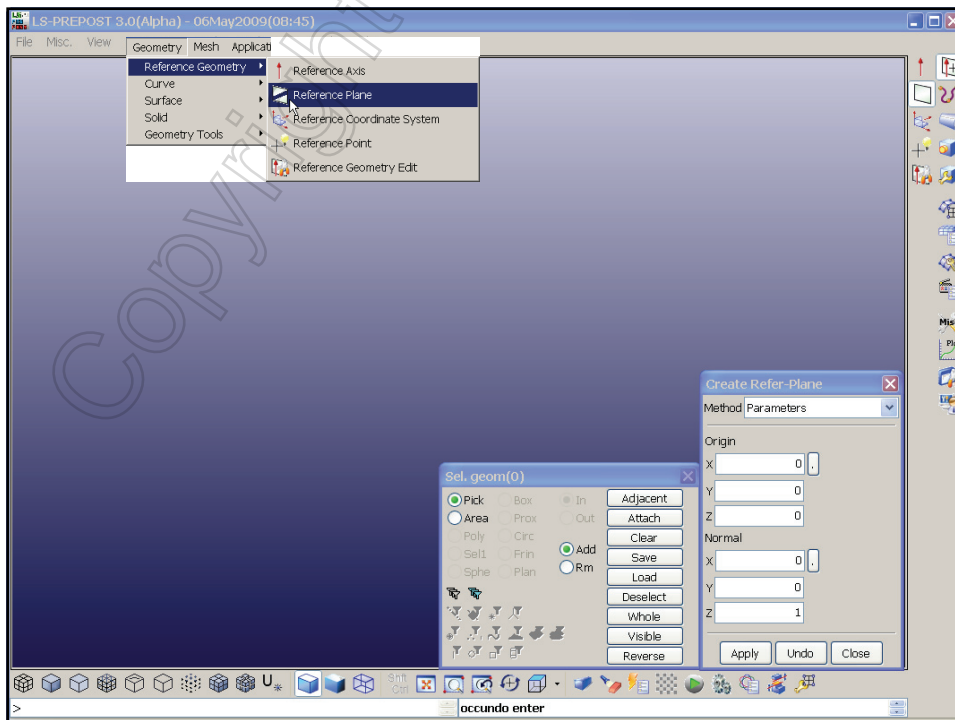
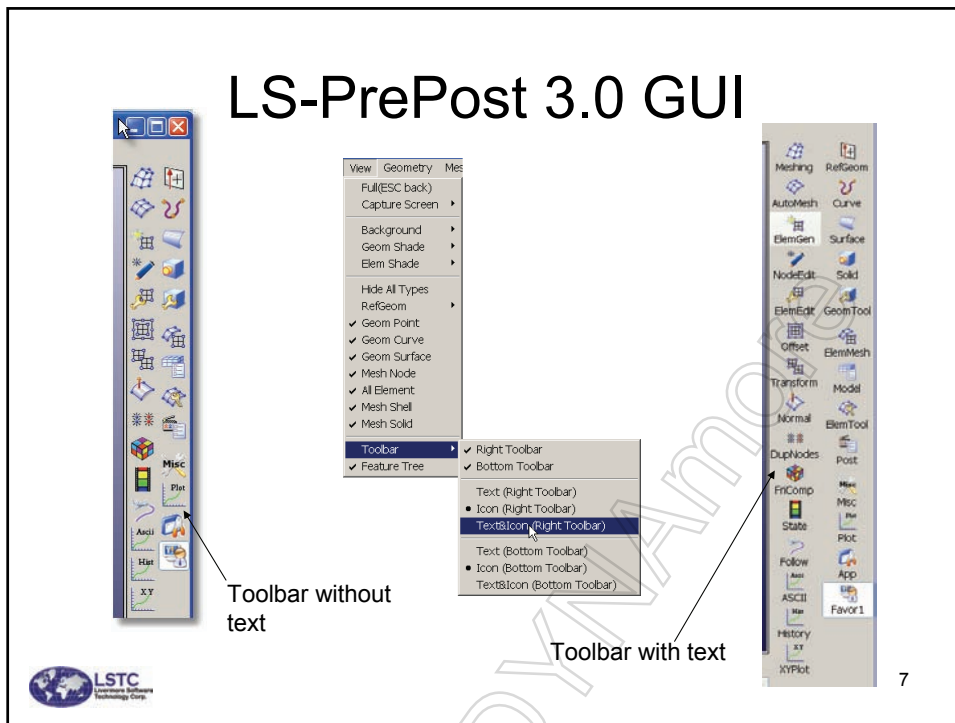
- LS-PrePost 3.0 uses toolbars and icons
- Provides the maximum graphics rendering space
- Icons with text or without text
- User configurable toolbars
- Functionality can be activated from icon or from pull down menu
- Only 2 popup dialogs at any one time
- Location of popup dialogs will be memorized



5

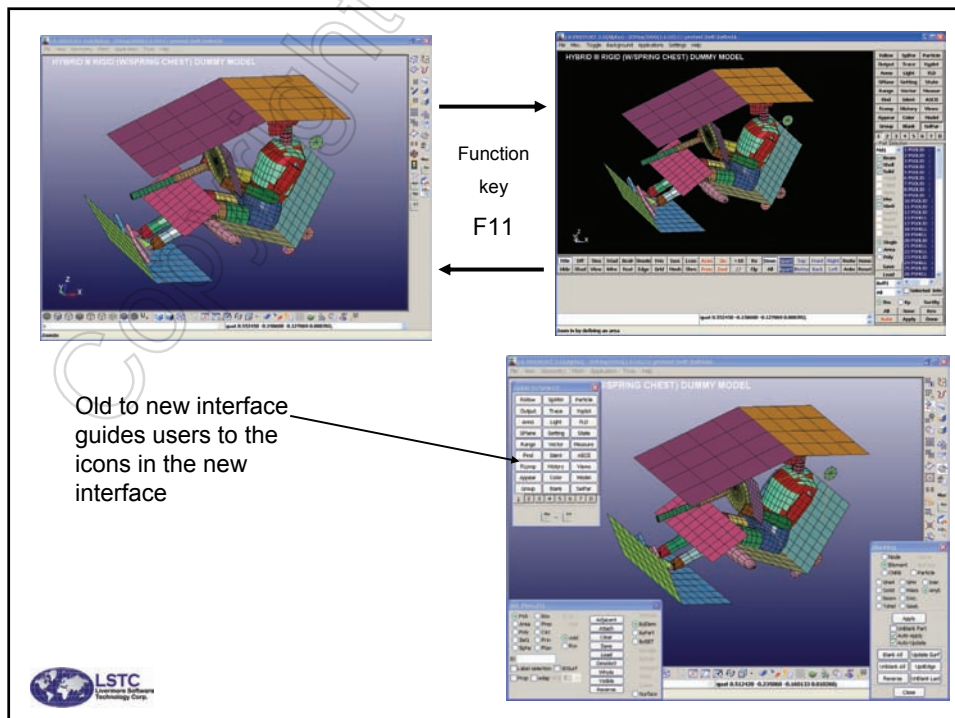


LS-PrePost 3.0 GUI



LS-PrePost 3.0 GUI

- Old interface still available and fully functional
- New and old interfaces can be switched with 1 key press (function key f11)
- An Old2New interface can transition users to the new interface without searching for the new icons
- Not all functions are available in new interface at this moment



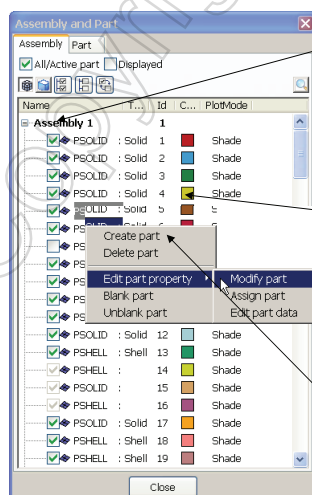
LS-PrePost 3.0 GUI

- Many functional interfaces have been changed to make it more intuitive and efficient
 - Selpart
 - Keyword input/edit interface
 - Model transformation
 - Translate, Scale, Rotate, Transform, Reflect and Project
 - LS-DYNA data creation interfaces
 - Configuration setting



11

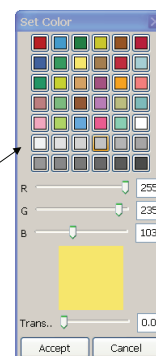
LS-PrePost 3.0 GUI



Assembly consists of geometry data and FE data

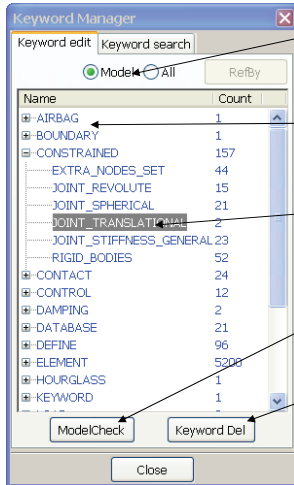
Right click on the color box to activate part color interface

Right click on the part name to activate different operations



12

LS-PrePost 3.0 GUI



Choose data for this model or All Keyword data

A tree form to list all Keyword data

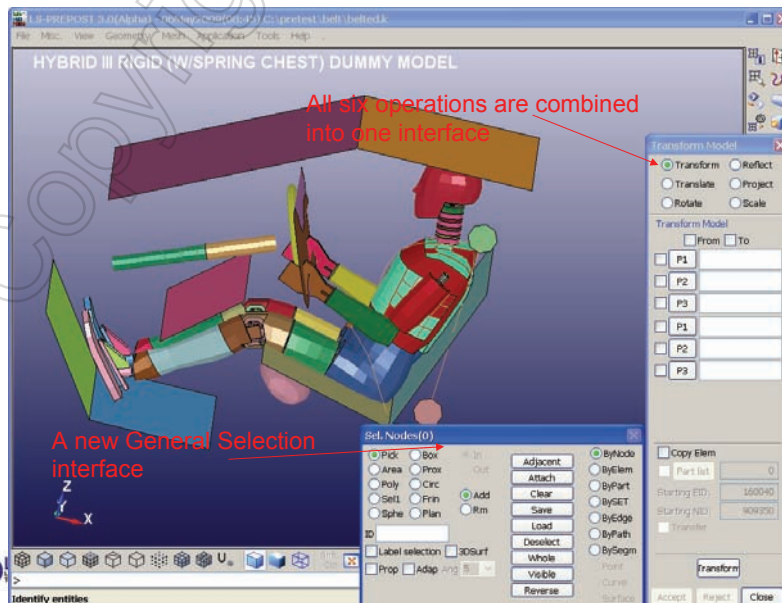
Double click the sub keyword name to pop up the keyword form

Model check can be activated from here

Keyword data can be deleted here



LS-PrePost 3.0 GUI



All six operations are combined into one interface

A new General Selection interface

All Isdyna data entity operation from old interface Page 5 are consolidated into one single tree

Each data entity will have its own interface in this area

The screenshot shows the 'LSDYNA Data Creation' dialog box. On the left, a tree view lists various data entities, with 'Set Data' highlighted. On the right, there are several control panels. The top panel has radio buttons for 'Show', 'Create', 'Modify', and 'Delete'. Below that is a dropdown for 'Type *SET_NODE'. The next panel has a 'Label' dropdown and a 'SetID' field. Below that are four 'DA' (DA1, DA2, DA3, DA4) input fields. The next panel has radio buttons for 'Pick ent' with sub-options 'In', 'Out', 'Partial', and 'Whole'. Below that is a 'Type: NodeSet' field and a 'Keyin' field. The next panel has radio buttons for 'Operation' with sub-options 'Show', 'Indent', and 'KCard'. Below that are 'All', 'None', and 'Rev' buttons. The next panel has 'All', 'None', 'Rev', and 'Card' buttons. Below that are 'Apply', 'Cancel', and 'Write' buttons. At the bottom is a list of node IDs: 1 (nodenum=17)(sub:1), 4 (nodenum=79)(sub:1), 6 (nodenum=71)(sub:1), 9 (nodenum=79)(sub:1), 50 (nodenum=4)(sub:1), 51 (nodenum=7)(sub:1), 52 (nodenum=5)(sub:1). A 'Close' button is at the bottom right.

LSTC
LSDYNA Software
Technology Core

Parameters that were set in the .Ispostrc file now can be modified interactively in the configuration Setting interface

Keyword output order can be set here

The top screenshot shows the 'Configuration Setting' dialog box. The left pane has a tree view with 'Keyword' selected. The right pane has several checkboxes: 'Partgrp_autocenter', 'Result_onscreen', 'Xyplotlegend', 'First time drawscene', 'Plot unreference node', 'Reordericon', 'Highlight_node', 'Texture_map', 'Help label', 'Highlight', 'Pinup_dialog', and 'Override_screen_aspect'. 'Xyplotlegend' and 'First time drawscene' are checked. 'Ok', 'Cancel', and 'Apply' buttons are at the bottom.

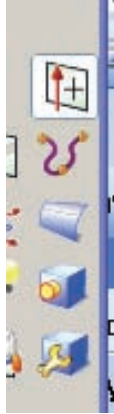
The bottom screenshot shows the 'Configuration Setting' dialog box with the 'Advanced Setting Save Keyword File' section. It has three tabs: 'Default', 'Expert', and 'Alphabetical'. Below the tabs are checkboxes for 'Freeformat style' and 'Field names'. A table lists keywords with their 'Name', 'Order', and 'FName' columns. The 'Name' column has checkboxes next to each entry. The 'Order' column has numerical values. The 'FName' column has checkboxes next to each entry.

| Name | Order | FName |
|--|-------|-------------------------------------|
| <input checked="" type="checkbox"/> AIRBAG(1) | 11 | <input checked="" type="checkbox"/> |
| ALE | | |
| <input checked="" type="checkbox"/> BOUNDARY(1) | 3 | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> CONSTRAINED(157) | 13 | <input checked="" type="checkbox"/> |
| COMPONENT | | |
| <input checked="" type="checkbox"/> CONTACT(24) | 5 | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> CONTROL(12) | 1 | <input checked="" type="checkbox"/> |
| DEFORMABLE | | |
| <input checked="" type="checkbox"/> DAMPING(2) | 14 | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> DATABASE(21) | 2 | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> DEFINE(96) | 10 | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> ELEMENT(5200) | 15 | <input checked="" type="checkbox"/> |
| EOS | | |

Ok Cancel Apply

LSTC
LSDYNA Software
Technology Core

Geometry Engine



- Online help for geometry operation
- Reference Geometry
- Curves
- Surfaces
- Solids
- Geometry tool

Geometry Engine – Online Help



Geometry Engine



- Reference Geometry Interfaces to create
 - Reference axis
 - Reference plane
 - Reference coordinate system
 - Reference points
- Reference geometry editing tools

Geometry Engine - Curve



- Curves Interfaces to create
 - Points, Lines
 - Circle, circular arc
 - Ellipse, elliptical arc
 - B-spline curve, helix, and composite curve
- Tools
 - Break curve, merge curve, bridge edges, and smooth curve

Geometry Engine - Surface



- Surface Interfaces to create
 - Plane, cylinder, cone, sphere, and torus
- Create surfaces
 - filling plane by edges, or by points
 - by extruding curve
 - by revolving curve
 - by sweeping curve along another curve

21

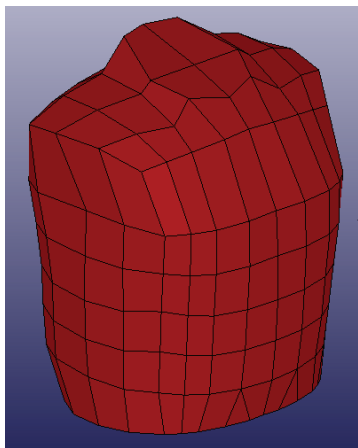
Geometry Engine - Surface



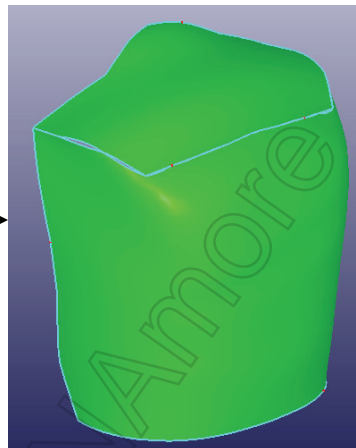
- Create surfaces
 - by lofting over multiple sections
 - by patching surface with 2 to n edges
 - by bridging two surfaces
 - by combining multiple surfaces
 - By fitting over points (xyz points) or finite element mesh

22

Geometry Engine - Surface



Finite Element Mesh



Geometry Surface

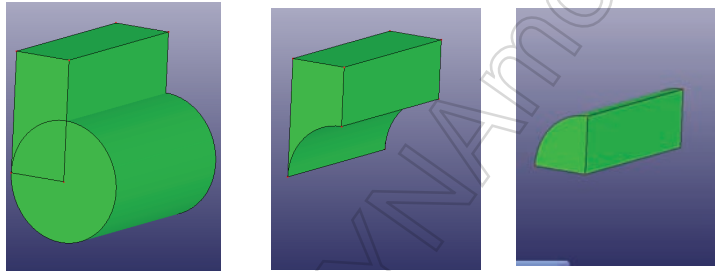
Geometry Engine - Solid



- Solid interface to create
 - Box, cylinder, cone, sphere, torus
- To create solid
 - By extruding faces
 - By revolving faces
 - By sweeping faces along a curve
 - By lofting over cross sections
 - By thickening shell surfaces

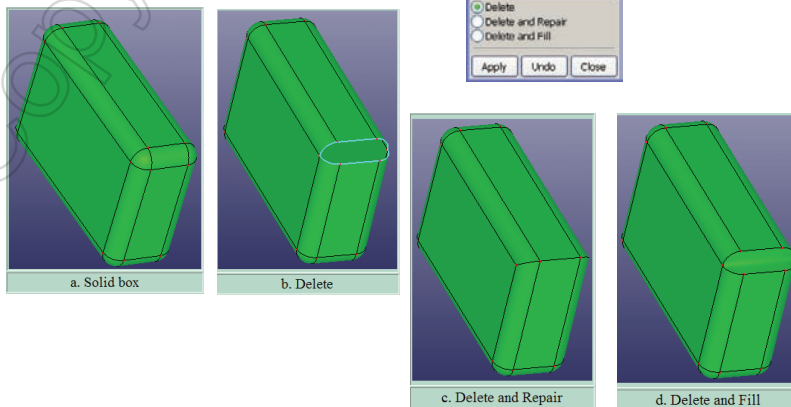
Geometry Engine - Solid

- To create solid
 - Solid edges can be fillet or chamfer
 - Solid block with wedge
 - Solid block Boolean operation



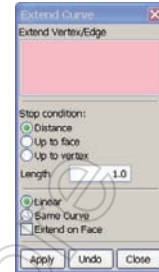
Geometry Engine – Geometry Tools

- Delete surface

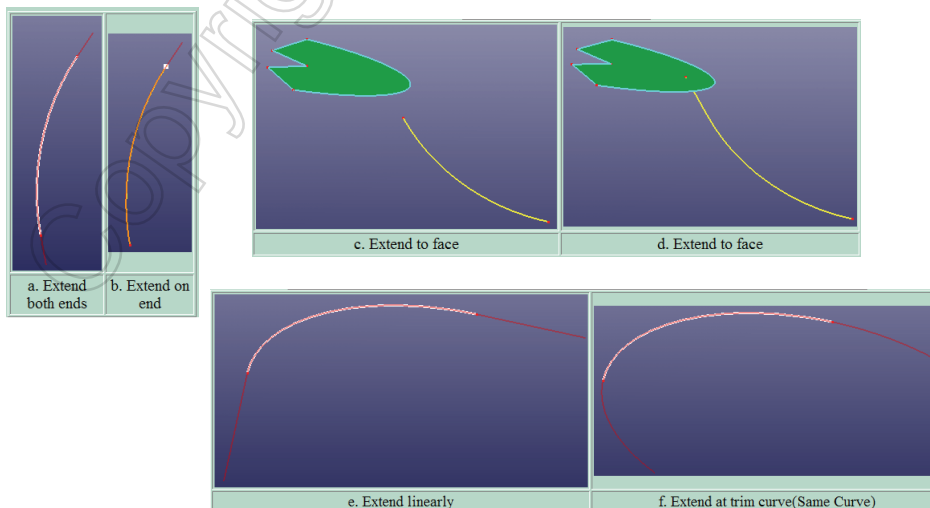


Geometry Tools – extend curve

- Extend curve stop condition
 - Extends by distance
 - Extends to a specified surface
 - Extends up to vertex
- Extend curve extension type
 - Linear - extends curve tangent to the original curve along the vertices
 - Same curve – extends the curve along the geometry of the curve
 - Extend on face – extends the curve on the face if the curve locates on any face

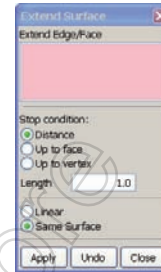


Geometry Engine – extend curve

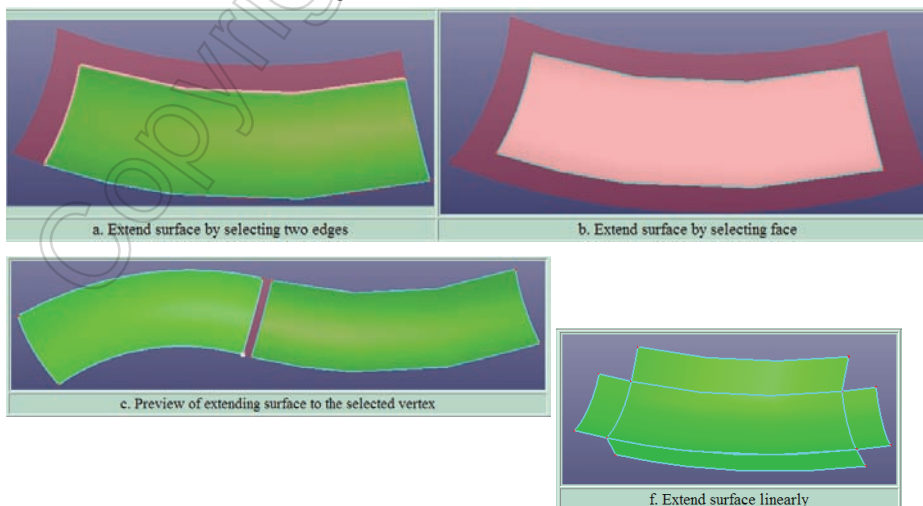


Geometry Tools – extend face

- Extend face stop condition
 - Extends by distance
 - Extends to a specified face
 - Extends up to vertex
- Extend face extension type
 - Linear - extends face tangent to the original face along the edges
 - Same surface – extends the face along the geometry of the face

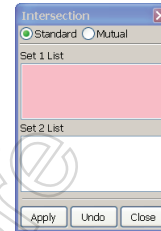


Geometry tool – extend face

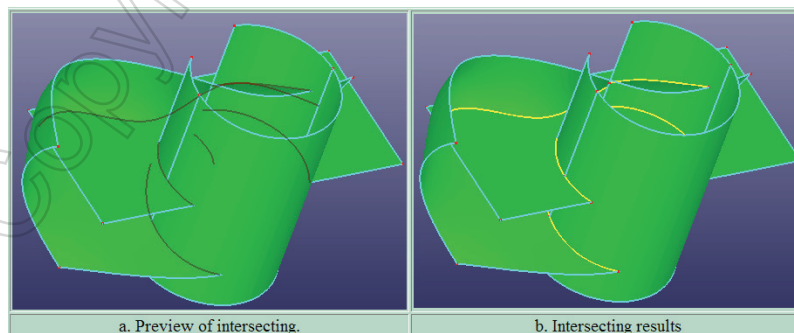


Geometry Tools - Intersection

- Intersection – select edge or face to calculate intersection of point or curve
 - Standard - Select edges, faces into group 1, select other edges, faces into group 2, and the shapes in groups 1 will intersect with the shapes in group 2
 - Mutual - Select edges, faces into the group, and the shapes intersect with each other in the group

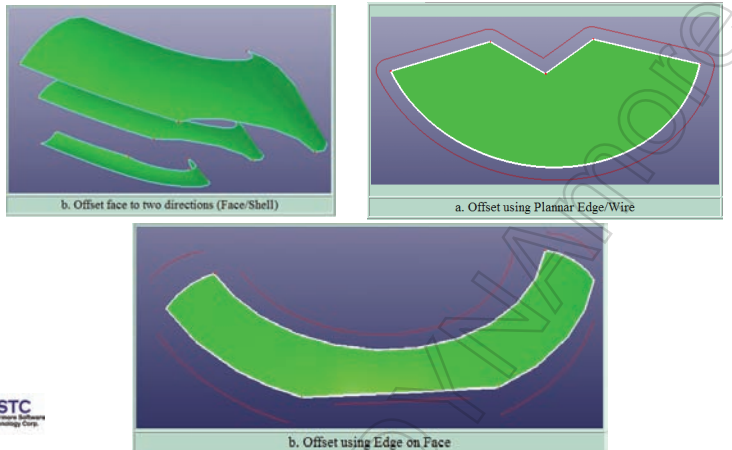


Geometry Tool - Intersection



Geometry Tools - Offset

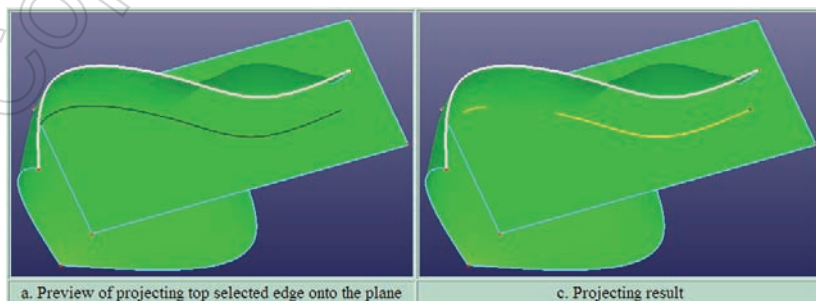
- Offset – offset a face/shell, a planar edge/wire or an edge on the face



33

Geometry Tools - Project

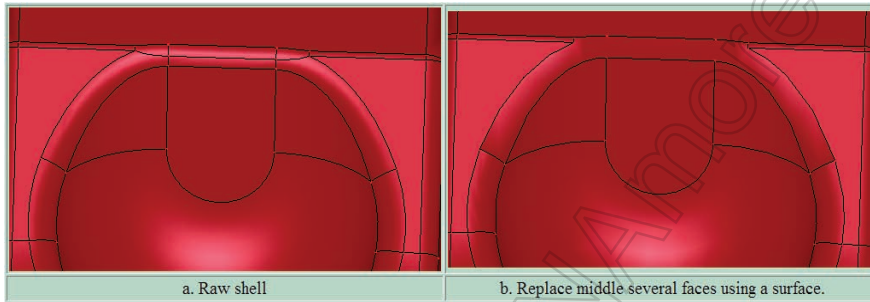
- Project – Given a direction, you can project vertex, edge or wire to a destination face or shell



34

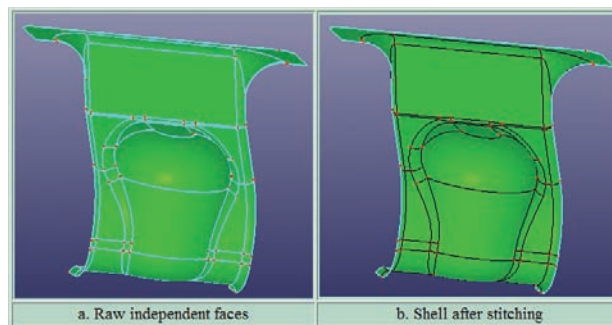
Geometry Tools – Replace Face

- Replace face – replace raw faces from a shell or solid by other new faces



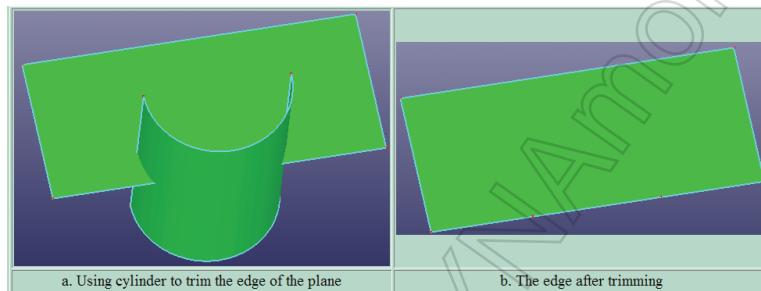
Geometry Tools – Stitch Faces

- Stitch faces – sew independent faces into a shell using Stitch Faces. If shell is closed with no open boundary, then it becomes a solid.

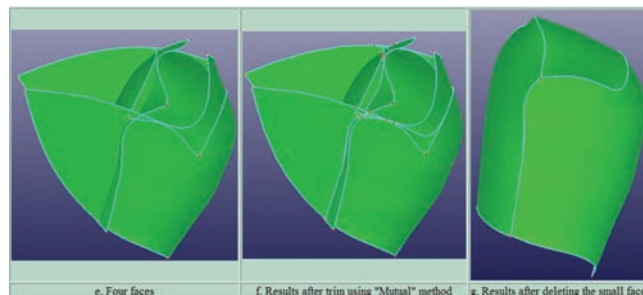
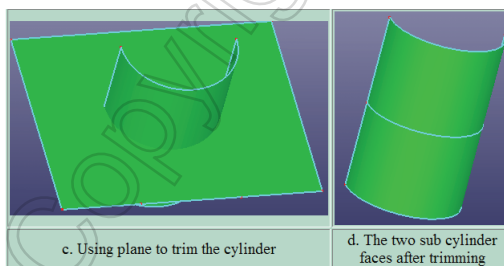


Geometry Tools – Trimming

- Trimming – trim edge or face by using other edge, wire, or face
- Trimming type
 - Standard – use standard entities to trim other entities
 - Mutual – Trim multiple faces using the faces themselves



Geometry Tools - Trimming



Geometry Tools – Transform and Copy

- Transform – Translate, rotate, mirror, or scale any shape or ref-geometry
 - Translate - Select an axis as direction of translation
 - Rotate – Select an axis as axis of rotation
 - Mirror – Select a point, axis or plane as the reference point or reflection
 - Scale – Select a point as the reference point of scaling
- Copy – Duplicate any geometry data

Geometry Tools - Management

- Geometry data management –
 - Blank/unblank
 - Delete
 - Export – Output geometry data in IGES or STEP file format
 - SplitShell – Split all shells and solids into independent faces
 - ClearModel – Remove all shapes or reference geometry from current model

Geometry Tools – Model Healing

- Heal model – Fix geometry errors such as duplicated faces, small faces/edges, abundant vertices and holes. Also to modify shape by replacing edge from face, add vertex to edge, etc.
- Topology simplification – untrim face, search and remove inner hole, search and fix fillet surface, search and remove fillet edge and reshape edge.

Geometry Tools – Measure

- Measure
 - Measure the distance between two points
 - Measure the radius and angle of the circular arc
 - Check the normal of the plane
 - Check if two circles are co-center
 - Check if two lines are parallel
 - Show or hide the ID of any geometry entities

LS-PrePost 3.0 Applications

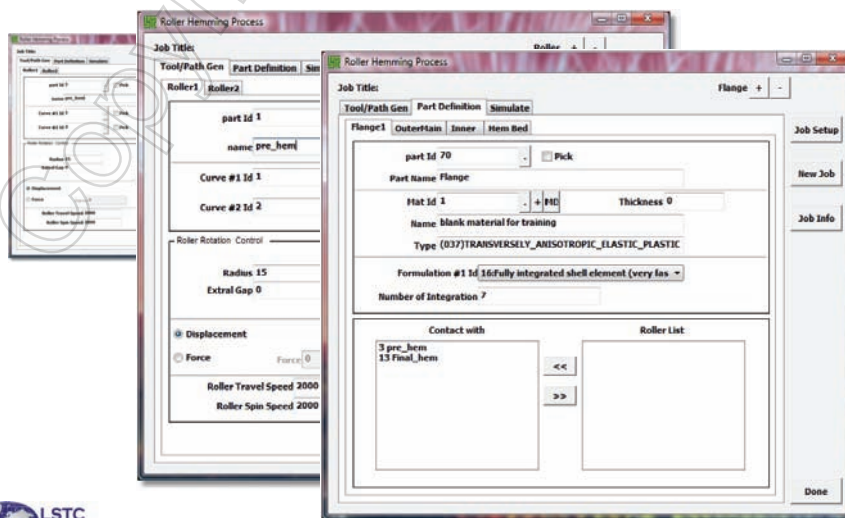
Roller Hemming Job Setup

- Flange bending use robotic hemming roller
- Support multi-roller definition
- Roller motion curves generated automatically
- Easy simulation job setup
- Use LS-DYNA explicit solver

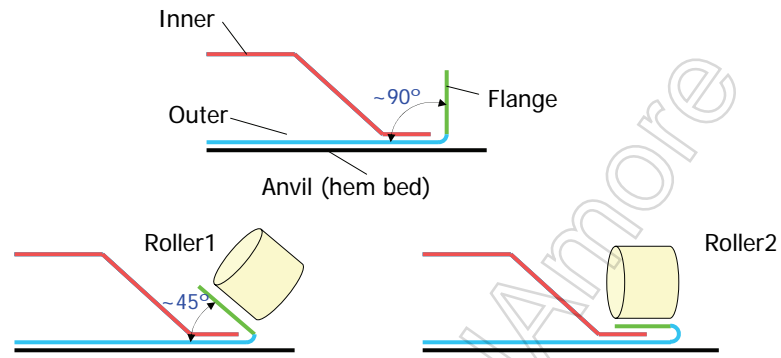


43

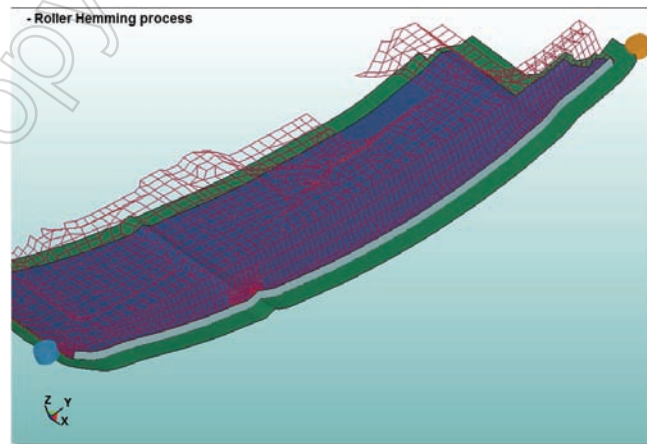
Roller Hemming interface



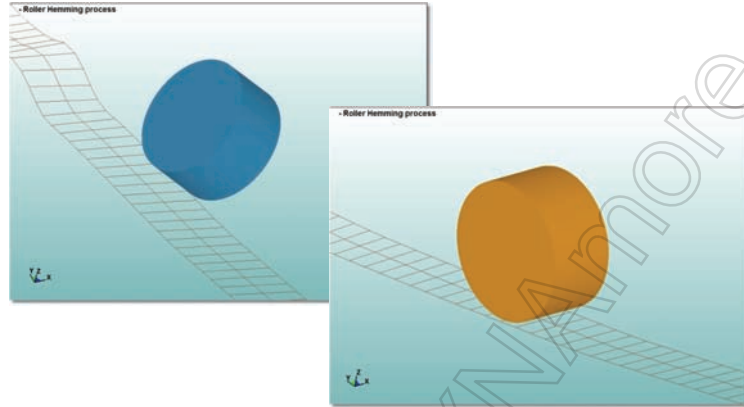
Roller Hemming example



Roller Hemming example



Roller Hemming example



LSPrepost3.0 ALE module

- Designed to greatly facilitate the ALE/FSI model buildup process.
- Guides users through different aspects of ALE/FSI model setup
- Embedded checking to eliminate input file errors.
- Interactive tool to generate the initial volume fractions for immediate onscreen display.
- It is a powerful preprocessing tool to build LS-DYNA ALE/FSI applications



49

1. Outline of ALE application

- **Input**
model with mesh
(Material, Eos and Hourglass Optional)
- **Output (LS-DYNA ALE input deck)**
Model mesh file
Model volume fraction file (if with volume filling)
ALE input deck main file which includes mesh file and volume fraction file
- **Define**
Group/Mat
Simulation Control
Volume
Initial Condition and Boundary Condition
Mesh Motion
FSI (Fluid-structure interaction)
- **Interactive tools**
Select parts, elements, nodes, and segments, from id list or from graphics
Input keyword data by forms
Define and view volume geometry
Create volume fractions and preview fluid parts on screen after volume geometry is defined
Automatic data checking such as group/mat, ALE mesh parts and all defined data



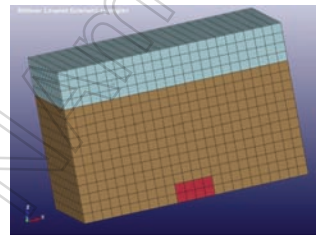
50

2. Simple ALE model

We start with the following setup as shown in the figure below. There are three parts with each part modeling an ALE material, respectively.

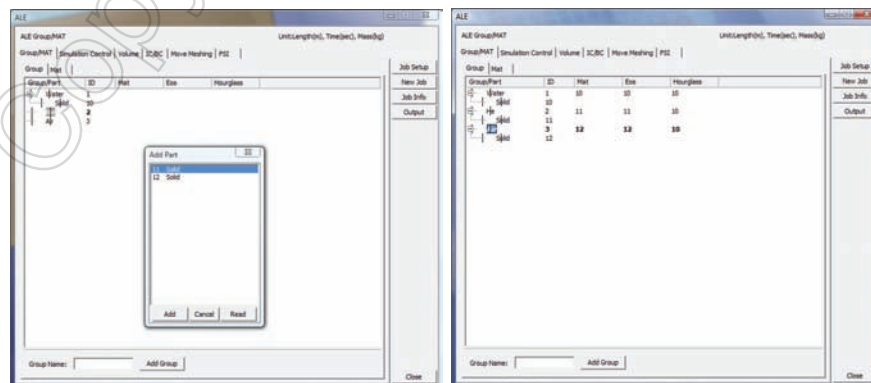
2.1 Model description

| ALE Multi-Material Group | Material Properties specified | Mesh |
|--------------------------|-------------------------------|---------|
| AMMG 1: Water | Part 10 (NULL+GRUNEISEN) | Part 10 |
| AMMG 2: HE | Part 11 (HE_BURN+JWL) | Part 11 |
| AMMG 3: Air | Part 12 (NULL+LIN_POL) | Part 12 |



2. Simple ALE model

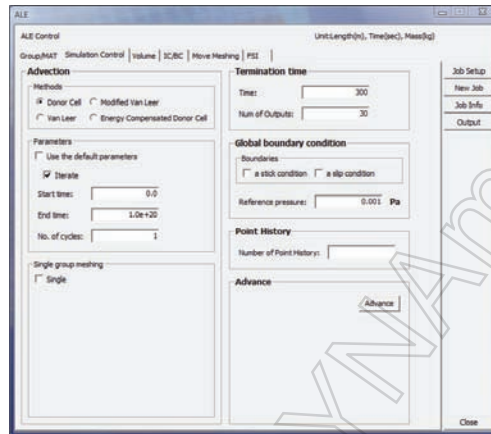
2.2 Define Group, Mat Water, High Explosive, Air



2. Simple ALE model

2.3 Simulation Control

termination time, number of states output



53

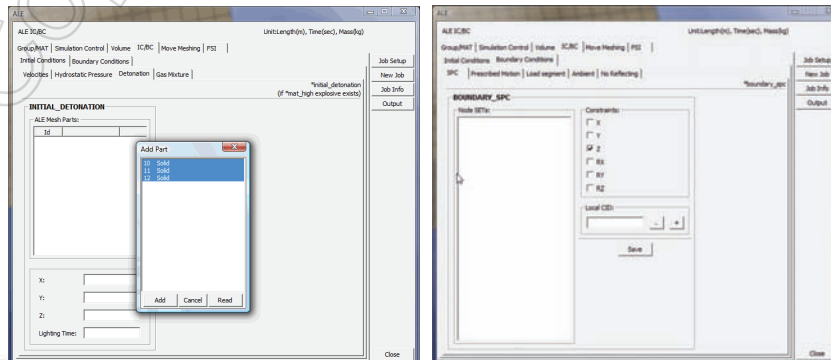
2. Simple ALE model

2.4 Define Initial Condition and Boundary Condition

Initial Detonation

all ALE mesh parts for detonation

Boundary SPC



54

2. Simple ALE model

2.5 Output DYNA input deck files

Model mesh file
ALE input deck main file which includes mesh file

ALE Output

Model File: ls_ale_model.k

Volume Fraction File: ls_ale_vfr.k

ALE File: ls_ale.k

Dyna Version: V971

CPU Number: 1

Master Folder: E:\test\ale\test1

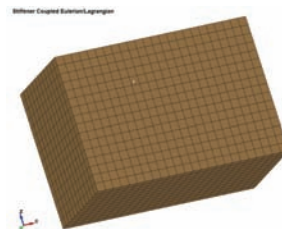
Sub-Folder: ls_ale

3. Initial Volume Filling

Instead of specifying each ALE material a mesh part, we define one mesh part for the whole ALE domain. And then by using the initial volume filling technique, we fill in the ALE materials.

3.1 Model description

| ALE Multi-Material Group | Material Properties specified | Mesh |
|--------------------------|-------------------------------|---------|
| AMMG 1: Water | Part 10 (NULL+GRUNEISEN) | Part 10 |
| AMMG 2: HE | Part 11 (HE_BURN+JWL) | |
| AMMG 3: Air | Part 12 (NULL+LIN_POL) | |



3.2 Group, Mat Simulation Control and IC/BC Initial Detonation Boundary SPC

3.3 Define Volume Volume Geometry Sphere fill in the HE

- Change the water (AMMG 1) to He (AMMG 2)
- Plane fill in the air
- Change the water (AMMG 1) to Air (AMMG 3)
- Create volume fraction and Preview fluid parts



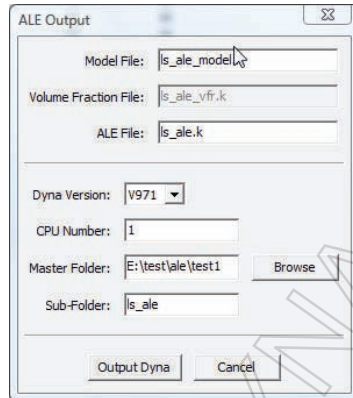
Stiffener Coupled Eulerian-Lagrangian

Component and Part

58

3.4 Output DYNA input deck files

- Model mesh file
- Model volume fraction file
- ALE input deck main file which includes mesh file and volume fraction file

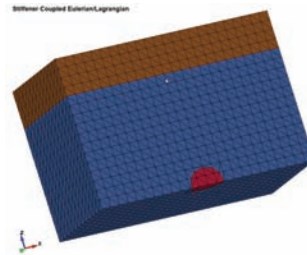


4. ALE/FSI Model

In this model setup, we are going to add mesh motion and Fluid Structure Interaction (FSI)

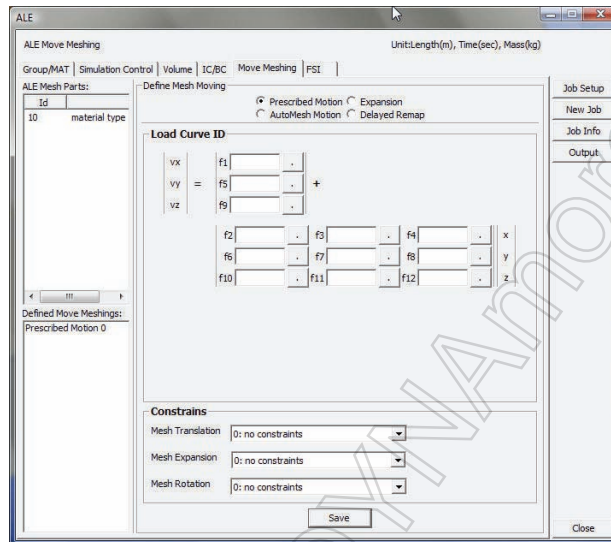
4.1 Model description

| Material Definitions | *MAT | *EOS |
|----------------------|--------------------------|----------------------------|
| Air | *MAT_NULL | *EOS_LINEAR_POLYNOMI AL |
| Water | *MAT_NULL | *EOS_GRUNEISEN |
| HE | *MAT_HIGH_EXPLOSIVE_BURN | *EOS_JWL |
| Steel | *MAT_PLASTIC_KINEMATIC | |



4.4 Define Mesh Motion

a delayed mesh motion with a scale factor of 0.05 to make the mesh motion follow the shock wave as much as possible



61

Outlook

- LS-PrePost 3.0 establishes a foundation with new graphical user interface that gives a modern look and feel
- Geometry engine will help building model and gives better mashing capability
- New applications can be easily added in the future
- Only Windows and Linux platforms will be supported

62