

# Latest Developments in the Oasys Suite of Software Programs for LS-DYNA

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Arup

# Latest Developments in Oasys Primer

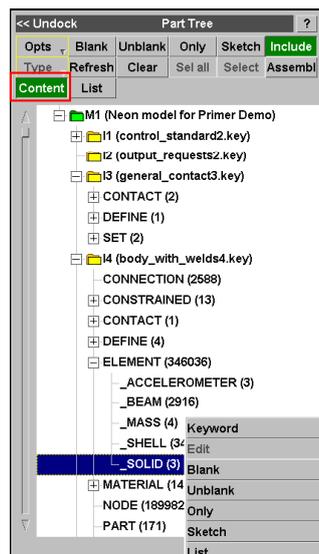
Oasys  
LS-DYNA ENVIRONMENT

Slide 1

ARUP

## Part Tree – Contents Mode

- Part Tree can now display the numbers of each keyword in each Include File – use the new Contents button.
- Categories (e.g. \*ELEMENT) can be expanded into keywords (\*ELEMENT\_SHELL etc).
- Right-click on a category for more options:
  - “Keyword” = Keyword editor.
  - “Edit” = available only when a single entity is selected.
  - Blank/Unblank/Only/Sketch to view the entities.
- By default, the Part Tree shows the contents of each Include file, but the display can be changed to show the number of each keyword in the whole model.



Oasys  
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Slide 2

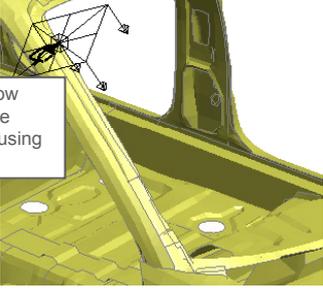
ARUP

\*DATABASE\_CROSS\_SECTION



- New option to create planes normal to free edge or feature line.
- Click on a node on a free edge or feature line.
- Primer automatically calculates the plane normal.
- Can also move the proposed plane along the free edge by a specified distance using + and - buttons.

Sketch now shows +ve direction using arrows



Abort Create
Reset All
Help

Create XSECTION
Copy Existing
Sketch

Undo Create
Check Defn

Pick point P1

Label: 6
Give label
\_PLANE
\_SET

Title: Example

PSID	XCT	YCT	ZCT	XCH	YCH
1001435	2382.2056	-974.13367	-140.23743	3382.2056	-974.13367
XHEV	YHEV	ZHEV	LENL	LENM	ID
2382.2056	25.866333	-140.23743	200.0	200.0	0

Drag translate
Drag rotate
Auto creat
Move by half eleme

Local system type:

Feature line

Local system type

Origin + vectors

3 nodes

Constant X

Constant Y

Constant Z

Norm to feat. line

Point 1 position:

P 1 at centre

Auto CS 1



Slide 3

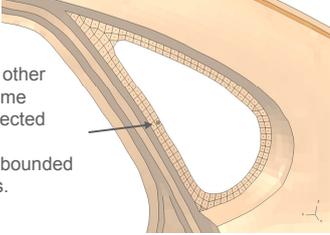


Selection enhancements



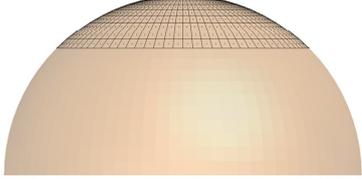
- When using Filter, the filter entity type can now be screen-picked.
- Opt=>"Only selected" can be used in object menus to display only the selected items.
- Selected entities can be added directly to the clipboard through the object menu.
- The object menu selection can now be reversed.
- Entities can be selected by feature line:

Surface bounded by feature line



Pick one shell; other shells in the same surface are selected automatically. "Surfaces" are bounded by feature lines.

Surface by normal angle deviation from picked shell





Slide 4



### Orient with INCLUDE\_TRANSFORM



- If "consider include transform" is set, Primer will check the selection to see if all nodes of include file(s) are selected.
- If so, option is offered to apply the orient by creating/modifying \*INCLUDE\_TRANSFORM rather than the normal mode - changing the nodal coordinates.

INFORMATION

CREATE/MODIFY \*INCLUDE\_TRANSFORM
USE EXPLICIT ORIENT

All nodes of include transform file 'rh\_front\_wheel.key' are selected for orientation.

Your orient may be achieved by

- explicit orientation (recommended for existing \*INCLUDE\_TRANSFORM)
- creating/modifying \*INCLUDE\_TRANSFORM.

- If nodal coordinates do not match, however, action will be blocked. You need to save the current position by writing out the include.

OK

Current nodal coordinates do not appear to match those in original include file(s).  
 Use of Include\_Transform is invalid. You orient has been blocked.  
 The threshold used is 1e-6\*model diags = 0.00770432. Max diff is 222.014 @ node 326952.  
 You may use setting 'Options > Program Options > Model modified > threshold' to increase this.

Orient

Project	Rotate	Translate	Help
Reflect	Scale	Trans-rot	Sketch
Apply	Copy off 1	Options	

REFLECT 3 PART(s)

Ref Axis: X axis Y axis Z axis

Ref dist: Pick 0.0

Drag Consider INCLUDE\_TRAN

SCREEN PICK

Dismiss Help

Picked 3 PART(s)

Scr_Area	All_Vis
Scr_Circ	Scr_Poly
Feat_Line	Ang 20
Feat_Abs	Explain

ORIENT ITEMS

All None ↑↓ Opt

Filter Vis Key\_In Sk

OBJECT TYPE

PART(s) (all models)

M1/P202 (MC-RIM-FT-L

M1/P203 (MC-RIM-FT-

M1/P204 (MC-RIM-RR-

M1/P205 (MC-RIM-RR-

M1/P210 (MC-TIRE-FT-

M1/P211 (MC-TIRE-FT-



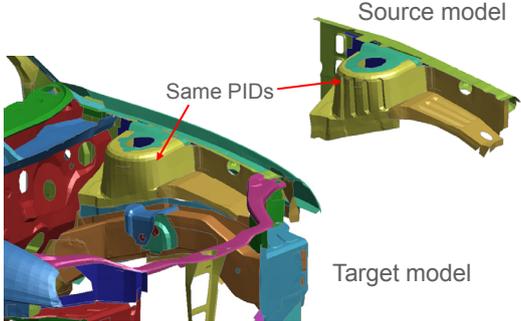
Slide 5



### Part Replace



- New option to replace multiple parts in one operation.
- In this case, the Part IDs in the target and source models must match.
- New capability for re-attaching items from Target Model:
- Primer now offers to re-attach each to the nearest node in the new parts.



Source model

Target model



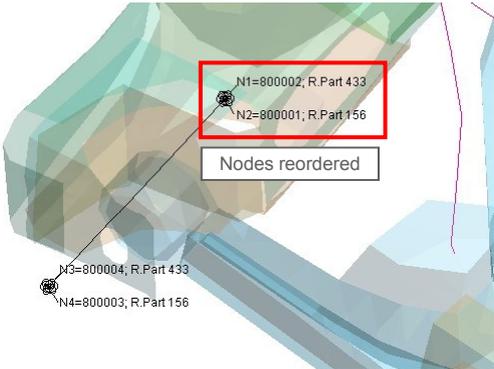
Slide 6

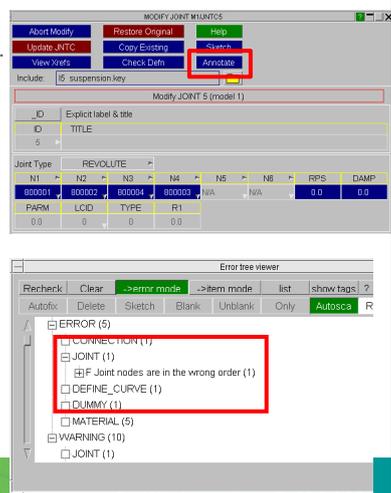


## Joints



- “Annotate” can be used to visualise the node-rigid body relationships for a joint.
- During a model check, Primer now identifies when the nodes in joints have been defined in the incorrect order.
- An autofix will automatically reorder the nodes.





ID	Explicit label & title
5	

Joint Type	REVOLUTE												
N1	N2	N3	N4	N5	N6	N7	PPIS	DAMP					
60001	60002	60004	60003	N/A	N/A		0.0	0.0					
PARAM	LOC	TYPE	R1										
0.0	0	0	0.0										

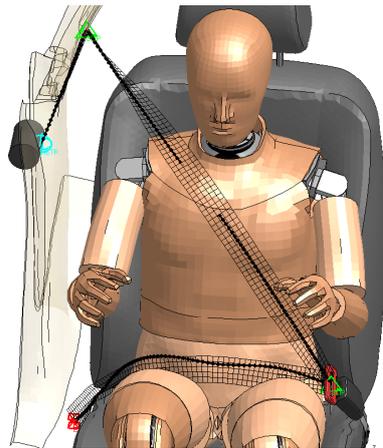


Slide 7


## Seatbelt Fitting Enhancements



- The seatbelt fitting process has been improved in 9.4.
- Same overall style.
- New features include:
  - Can create “shell seatbelts” (4-node belt elements, new in 971 R4), or mixed 1D + shell belts.
  - Control twist at path points.
  - Automatically create slings and retractor, using nodes picked by user.
  - Data checking stage.





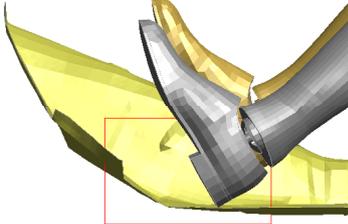
Slide 8


Dummy positioning with contact



During positioning, contact checking can be switched on/off.

This prevents dummy parts from penetrating the parts in the contact part set, in "drag assembly" and in "move points" modes.



Dummies						
Curr: M1DUMM1.H-pt: 2425.899 329.7 549.5195						
Position parts						
<b>Accept</b>	Accept and save changes					
<b>Reject</b>	Reject and undo changes					
<input type="checkbox"/> Rotate angles	<b>Explain</b>	<b>Options...</b>				
<input type="checkbox"/> Drag assembly	<b>Reset all</b>		<b>Save/Retrieve</b>			
<input type="checkbox"/> Move points						
Assembly (click to edit)						
	Cont	Lock tr	Lock rot			
1: Lower Torso	T all	x y z	R all	x y z		
2: Thorax	T all	x y z	R all	x y z		
3: Head & Neck	T all	x y z	R all	x y z		
4: Upper leg left	T all	x y z	R all	x y z		
5: Upper leg right	T all	x y z	R all	x y z		
6: Lower leg left	T all	x y z	R all	x y z		
7: Lower leg right	T all	x y z	R all	x y z		
8: Foot left	<b>C</b>	x y z	R all	x y z		
9: Foot right	T all	x y z	R all	x y z		
10: Yoke left	T all	x y z	R all	x y z		
11: Yoke right	T all	x y z	R all	x y z		
12: Upper arm left	T all	x y z	R all	x y z		



Slide 9

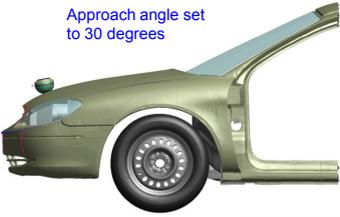


Model Build –New CSV Inputs for Pedestrian Impact

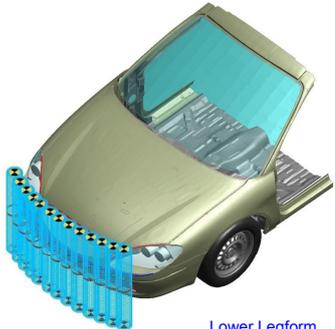


- New build types added - Head Impact at Angle, Lower Legform & Upper Legform.
- For each data point in the Positioning File, Primer will create one model.

Approach angle set to 30 degrees



Upper Legform



Lower Legform



Slide 10

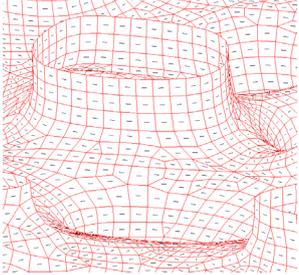


Local axis display

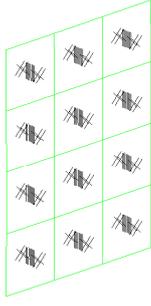


• New options to display the material axes for orthotropic materials (solids and shells). This takes account of:

- AOPT data on the material card.
- BETA angles on \*ELEMENT\_SHELL.
- B1, B2... angles on \*SECTION\_SHELL with ICOMP=1.
- \*ELEMENT\_SOLID\_ORTHO.
- Airbag reference geometry.



z	z	z	z	z
z	z	z	z	z
		z	z	z





Slide 11



Javascrpts given out with 9.4



Four JavaScripts are given out with the 9.4 release:

- Moved Parts (was also given out with 9.3) – compare two models, unblank only those parts with moved or renumbered nodes or elements.
- LSTC Dummy Converter – reads the LS-PrePost tree file from a dummy model, converts to Primer format.
- Multi-dummy positioner – creates multiple models, with the dummy and seat position for each model taken from a csv file. Includes belt fitting and seat foam compression. See next slides.
- Section property calculator – Calculates section properties (Area, Ixx, Iyy, etc) for the shell elements cut by a \*DATABASE\_CROSS\_SECTION.



Slide 12



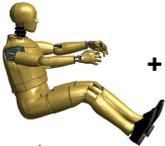
### Multiple Dummy/seat/belt Positioning

dummy.key  
seat.key  
belt.key

posn.csv

**JavaScript Tasks:**

1. Reads csv file and baseline models
2. Moves seat to new height / slide point
3. Moves dummy to new H-point
4. Moves other reference points e.g. hands, knees, etc, if required
5. Depenetrates seat foam
6. Refits seatbelt
7. Writes models
8. Can also submit analyses if required

  
dummy

  
seat

  
belt

  
CSV

+

+

+

=



This script will be released with Primer 9.4



dummy\_1.key  
seat\_1.key  
belt\_1.key

dummy\_2.key  
seat\_2.key  
belt\_2.key

dummy\_3.key  
seat\_3.key  
belt\_4.key

dummy\_4.key  
seat\_4.key  
belt\_4.key



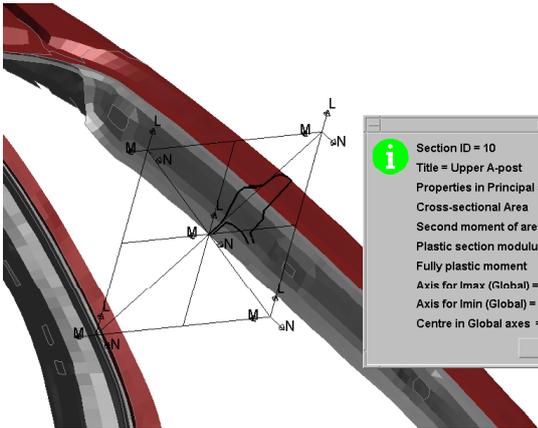
Slide 13



### JavaScript - Section Property Calculator

- This JavaScript calculates section properties (Area, Ixx, Iyy, etc) about the principal axes of the shell elements cut by a \*DATABASE\_CROSS\_SECTION.





Info

**i** Section ID = 10

Title = Upper A-post

Properties in Principal axis system:

Cross-sectional Area = 357.517

Second moment of area I<sub>max</sub> = 231016 I<sub>min</sub> = 108564

Plastic section modulus Z<sub>pmax</sub> = 6471.93 Z<sub>pmin</sub> = 7899.31

Fully plastic moment M<sub>pmax</sub> = 1568.56 M<sub>pmin</sub> = 225.151

Axis for I<sub>max</sub> (Global) = (0.102892, 0.880268, 0.590763)

Axis for I<sub>min</sub> (Global) = (0.516951, -0.550708, 0.656137)

Centre in Global axes = (-1952.30, 656.164, 1160.20)

OK



Slide 14



Macros



- Why do we need macros?
- Primer 9.3 has cp file:
  - ✓ – Recorded automatically.
  - ✓ – Can replay the same sequence of operations on the same model.
  - ✗ – Cannot be edited or changed to suit a different model.
- Primer 9.3 has command files:
  - ✗ – Cannot be recorded.
  - ✗ – Limited capability.
- Primer 9.3 has JavaScript:
  - ✓ – Powerful method of creating new capabilities.
  - ✗ – Cannot be recorded.
  - ✗ – User must know programming language.
- Primer 9.4 has Macros:
  - ✓ – Can be recorded.
  - ✓ – Can be edited.
  - ✓ – Can access all the capabilities of Primer.



Slide 15



Macros



- Primer 9.4 can record macros from interactive use of Primer.
- Records menu system interactions.
- Human-readable.
- Editable.



```

Window("Contact").Button("Create")
Window("CREATE CONTACT in model 1").Popup("Label:")
PopupWindow1().Button("Highest+1 Layer")
Window("CREATE CONTACT in model 1").Button("Contact Type")
Window("CREATE CONTACT in model 1").Menu("CONTACT TYPE").Select1("AUTOMATIC_SURFACE_TO_SURFACE")
In Window("CREATE CONTACT in model 1")
  .Textbox("Static friction (fs)") = "      0.2"
  .Textbox("Dynamic friction (fd)") = "      0.2"
  .Button("Optional data..")
  .Textbox("Soft constraint opt (soft)") = "      1"
  .Button("=> Main Panel")
  .Popup("Set type (sstyp)")
End In
  
```



Slide 16



Macros



- When playing back, can choose to perform picking and dragging interactively, or replay the recorded picking and dragging explicitly.

Record Play

File: DEMIOCT08\_DEMOScontactfb.prm

Play

Replay pick/drag commands:

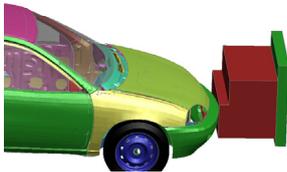
Replay view for pick/drag:

Ignore numbers in window titles:

Pause between commands (ms): 100

: pick and drag automatically at the same screen-positions as recorded

: user will be asked to pick and drag



Skipped 1 drag. Please do drag(s)

Press 'Resume' to continue playback

Resume

Generic message tells user to pick or drag. It may not be clear what the user has to pick, or why...

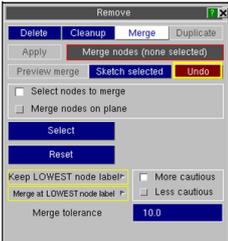


Slide 17 

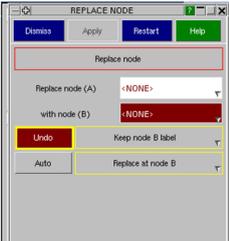
UNDO Capability



Node merge



Node replace



Mesh



Mesh split / combine

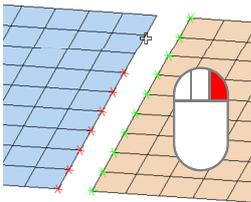


Undo capability has been added to certain Primer operations.

If several undo-able operations are performed in sequence, they may be undone in reverse sequence.

Performing a non-undo-able operation will prevent undo of previous operations.

Also right mouse button now deselects nodes for meshing



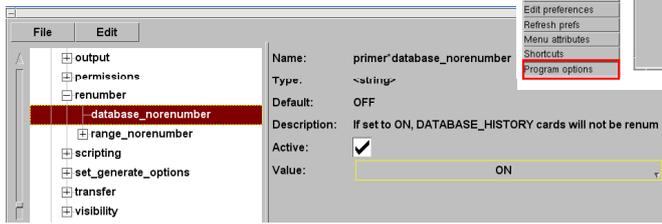


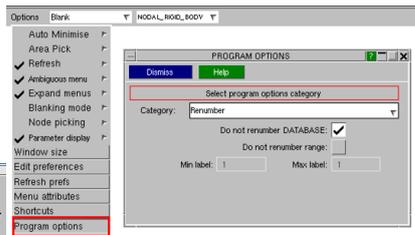
Slide 18 

### Renumbering Enhancements in 9.4



- Option never to renumber \*DATABASE\_HISTORY can be set in
  - Options → Program Options → Renumber tab.
- Option never to renumber any entity with label in a user-defined range.
  - Useful for connections between INCLUDE files.
- These options can also be set/saved as a preference.

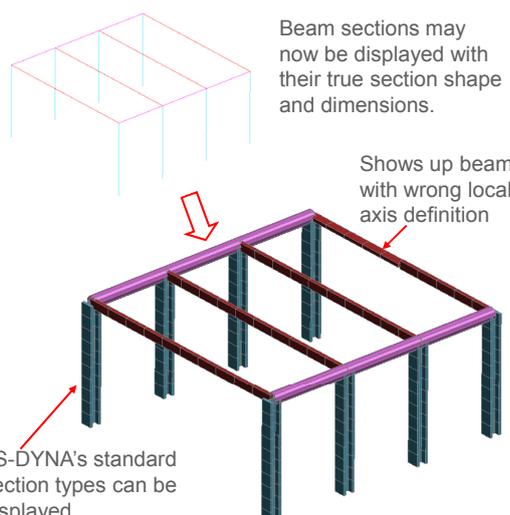





Slide 19


### Beam section display

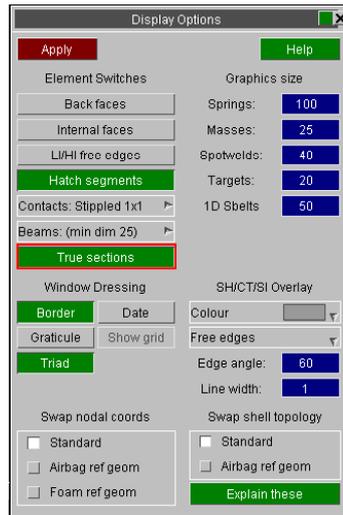




Beam sections may now be displayed with their true section shape and dimensions.

Shows up beams with wrong local axis definition

LS-DYNA's standard section types can be displayed




Slide 20


### Assembly hierarchy from other pre-processors



- With Primer 9.3, the user could create and display an assembly hierarchy interactively using the Part Tree
- Primer 9.4 can also read assembly hierarchy data from LS-DYNA keyword files written by HyperMesh and ANSA.
- When a keyword file is written out, a new option allows the assembly information to be written in Primer, HyperMesh or ANSA style.

Entities

- Assembly Hierarchy
  - body in white
    - Upper structure
    - Underframe
      - Floor
      - Front structure
      - Dash assembly
    - Bumpers
    - Spotwelds
  - suspension
  - engine
  - Hood
  - Left door
  - Tailgate
  - wheels
  - Right door
  - glazing

➔

Part Tree

- M1 (Demo model)
  - A1 (body in white)
    - A11 (Underframe)
      - A13 (Floor)
      - A14 (Front structure)
      - A15 (Dash assembly)
    - A12 (Bumpers)
    - A16 (Spotwelds)
    - A10 (Upper structure)
  - A2 (suspension)
  - A3 (engine)
  - A4 (Hood)
  - A5 (Left door)
  - A6 (Tailgate)
  - A7 (wheels)
  - A8 (Right door)
  - A9 (glazing)



Slide 21 

### Viewing – Target and Eye

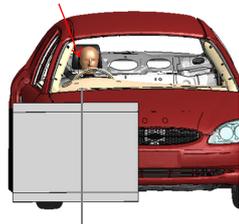


- Define camera (“eye”) and target locations.
- Primer calculates view angle and perspective.
- Saves time when comparing to test photos.

Pick EYE node



Pick TARGET node



Perspective distance



File Keywords Tools Display Images **Viewing** Options

- View manager
- Perspective
- Target & Eye**
- Match image
- Update Level
- 3D options
- 3D Graphics**
- 2D Graphics
- Settings

Viewing

Perspective Setting

Perspective switch Off Dist: 1.473E+04

Eye pos 2589.6 1071.1 1.547E+04 Scal 0.799

Targ po 2589.6 1071.1 738.8

NEARER

Locations can be input as:

1. x,y,z coordinates
2. Current view "{C}"
3. Pick node

Dismiss

Locate Target and Eye

Eye po 2589.6 1071.1 1.547E+04 {C} Pick node

Targ po 2589.6 1071.1 738.8 {C} Pick node

Up vector

Automatic Update view

Global X

Global Y Exp

Global Z

User def 0.0 0.0 1

Assign an "up" vector (e.g. global Z)



Slide 22 

### New Keyboard Shortcut: J = Attached

- Shortcut **J (Joined)** = find attached to visible
  - Tools → Attached → Apply
- Eg: to quickly edit a Nodal Rigid Body attached to this part...
  1. Set Quick-pick cursor entity to Constrained → Nodal Rigid Body
  2. Unblank attached entities using "J"...
- Note – Attached via tied contact is Off by default for shortcut J since it can slow the response. This can be switched on using a Preference.

Slide 23

### New Keyboard Shortcut: Y = Change Mesh Overlay

- New shortcut **Y (overlay)** toggles between free edge, all edges, and no edges.

all edges

no edges

free edges or  
feature lines  
(whichever is currently  
set in Display Options  
→)

Display Options	
Apply	Help
<b>Element Switches</b>	
Back faces	Graphics size
Internal faces	Springs: 100
LI/Hi free edges	Masses: 25
Hatch segments	Spotwelds: 40
Contacts: Stippled 1x1	Targets: 20
Beams: (min dim 25)	1D Sbelts: 50
True beam sections	
<b>Window Dressing</b>	
Border	Date
Graticule	Show grid
Triad	
<b>SH/CT/SI Overlay</b>	
Colour: [dropdown]	
<b>Feature lines</b>	
SH/CT/SI overlay	
No overlay	
Free edges	
Feature lines	
All edges	
Mirror the geom	
Explain these	
<b>Swap nodal coords</b>	
Standard	
Airbag ref geom	
Foam ref geom	

Slide 24

Text cut and paste

- Cut-and-paste capability to/from Primer user-input text box contents to/from applications outside Primer.
- This was available in 9.3 on Windows and on most Unix and Linux platforms but not on Linux KDE terminals.
- In 9.4 it works also on KDE terminals.

Copy from application outside Primer

Middle-click in text-box to paste

Drag across (left mouse) to copy

Paste into application outside Primer

Slide 25

Text cut and paste

- New capability for 9.4: text windows (e.g. Help boxes) can be copied to Windows Clipboard.

1. right-click

2.

Slide 26

Primer V10.0 Features



- Various new features are currently being added to the next release of Primer, V10.0.
- Some of these features are demonstrated in the conference presentation.



Slide 27



Contact Information



# ARUP

[www.arup.com/dyna](http://www.arup.com/dyna)

For more information please contact the following:

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or contact your local Oasys distributor



Slide 28



