

Automating and extending Oasys PRIMER and Oasys D3PLOT using JavaScript

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Summary:

This presentation covers scripting with Javascript in Oasys PRIMER and Oasys D3PLOT.

Keywords:

Oasys PRIMER; Oasys D3PLOT; Javascript; Scripting

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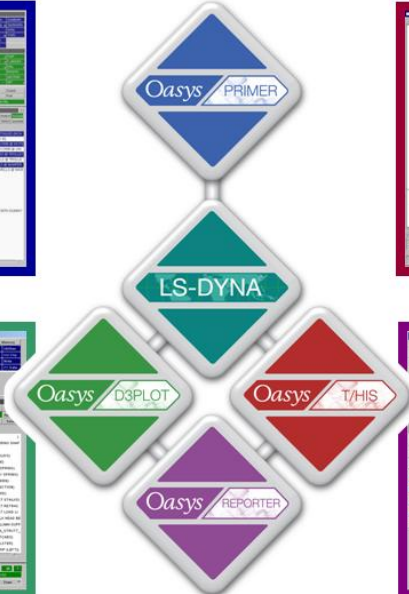
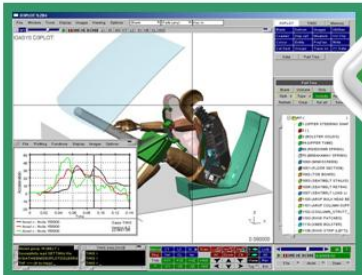


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Which Oasys software products have JavaScript?

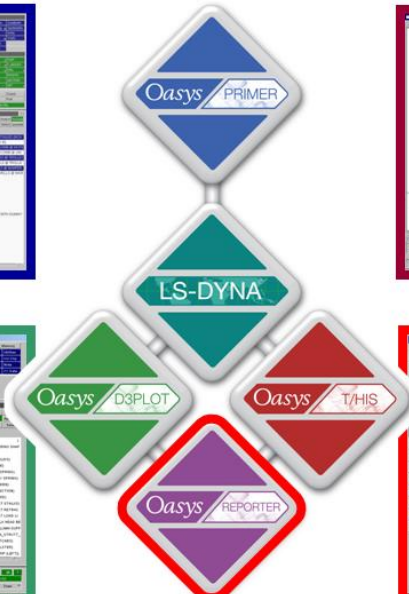


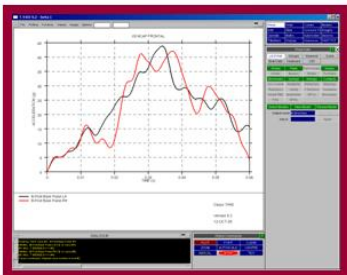
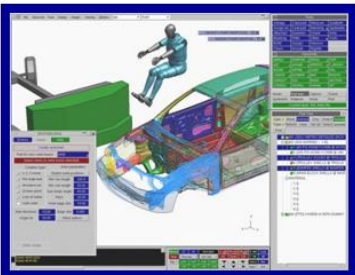


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Which Oasys software products have JavaScript?

Version 9.2



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Which Oasys software products have JavaScript? | Version 9.3


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PRIMER Scripting | Oasys PRIMER

- Scripts do not have to be compiled and the same script works on all platforms.
- JavaScript is a full-featured programming language syntactically similar to C, Java and Perl.
- Core features include variables, arrays, strings, objects, functions, regular expressions.
- Statements if, do, for, while, switch etc.
- Operators + - / * ++ -- && || etc (like C and Perl)
- Core functionality can easily be extended with new classes and methods.

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PRIMER Scripting





- Extensions so far

LS-DYNA keywords
Beam, Contact, Curves, Discrete, Hourglass, LoadNode, Mass, Material, Node, NRB, Part, PrescribedMotion, Section, Set, Shell, Solid, SPC, InitialStressShell, Vector


PRIMER entities and functions
Blanking, Colour, Connections, Image, Model, View, Xrefs

Other
File (text file reading/writing)
Widget, Window (ability to create new user interfaces in PRIMER)
XMLParser (XML file reading)
Command line functions can be called from JavaScript



Scripts can be assigned to function keys or buttons

PRIMER Scripting



- Possible applications
 - Meshing
 - Complex geometrical transformation (e.g. morphing, airbag folding)
 - Translators
 - Custom menus/user interfaces
 - Processes/Workflow
 - Dummy/seat multi-position via command line
 - Run external programs and import results into PRIMER (e.g. importing forming results from HYCRASH)
- Future development
 - Adding support for more LS-DYNA keywords
 - Interfacing with more functions in PRIMER
- User feedback needed
 - What tasks could scripting help you with?
 - Which PRIMER keywords/functions will you need to access?
- We will provide example scripts and full documentation

PRIMER Scripting



- Advantages:
 - Quick turnaround – don't have to wait for new version of PRIMER
 - Can keep your application confidential
 - Under your control – can do it yourself if you wish.
- Demos:
 - Creating a simple mesh
 - Reading a user defined connections file
 - Writing an input translator with a GUI
 - Finding moved parts
 - Multiple seat position



Demo 1: Creating a simple mesh



```
// Make model
var m = new Model();


// Make 11 rows of 11 nodes, with 10mm spacing
for (y=0; y<11; y++)
{
  for (x=0; x<11; x++)
    var n = new Node(m, 1+x*(y*11), x*10, y*10, 0);
}

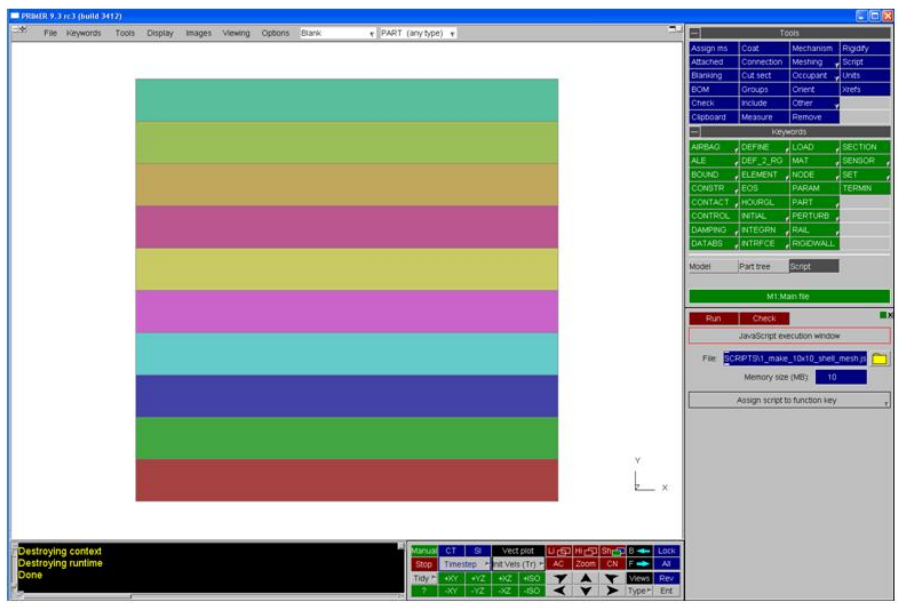
// Make 10 x 10 shells, each row in part a different part
for (i=1; i<=10; i++)
{
  for (j=1; j<=10; j++)
    var s = new Shell(m, // Model to make shell in
                      i+(j*10), // Shell ID
                      i, // Part ID
                      ((i-1)*11)+j+0, // Node 1
                      ((i-1)*11)+j+1, // Node 2
                      ((i-0)*11)+j+1, // Node 3
                      ((i-0)*11)+j+0); // Node 4
}



// Update graphics
m.UpdateGraphics();
View.Show(View.XY);
View.Ac()
```




Demo 1: Creating a simple mesh





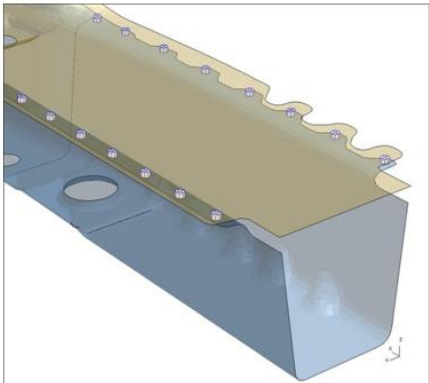
Demo 2: Reading a user defined connection file





Custom-format spotweld file

```


<welds>
  <weld>
    <coord>3734.050293 586.282166 2347.783936</coord>
    <pid>82151</pid>
    <pid>8700</pid>
  </weld>
  <weld>
    <coord>3694.061523 586.860229 2347.063721</coord>
    <pid>82151</pid>
    <pid>8700</pid>
  </weld>
  <weld>
    <coord>3654.075928 587.419556 2346.248291</coord>
    <pid>8700</pid>
    <pid>82151</pid>
    <pid>8710</pid>
  </weld>
</welds>
            
```


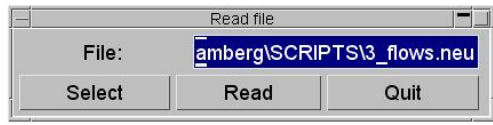


Run Script

Demo 3: Writing an input translator with GUI




→




```

// Create a panel to select which file to read in
var w = new Window("Read file", 0.8, 1.0, 0.5, 0.6);


// Create buttons in window
var l = new Widget(w, Widget.LABEL, 1, 30, 1, 7, "File:");
var t = new Widget(w, Widget.TEXTBOX, 31, 80, 1, 7, "");
var s = new Widget(w, Widget.BUTTON, 1, 27, 8, 14, "Select");
var r = new Widget(w, Widget.BUTTON, 28, 53, 8, 14, "Read");
var q = new Widget(w, Widget.BUTTON, 54, 80, 8, 14, "Quit");

// Make buttons do something when you click them
t.onChange = update;
r.onClick = read;
s.onClick = select;
q.onClick = Exit;
r.active = false;

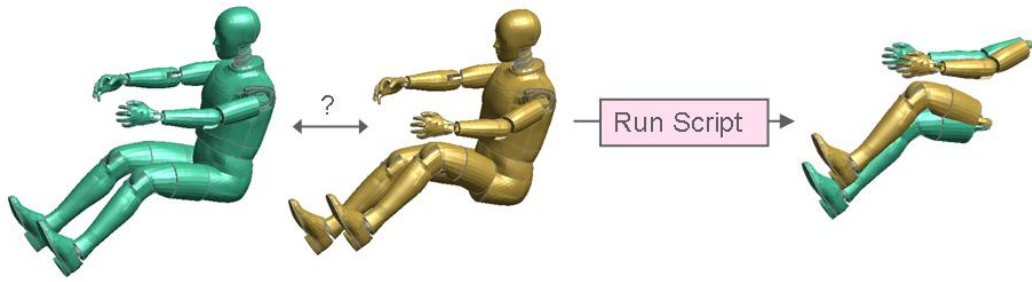
// Show the window
w.Show();
    
```

Demo 4: Finding moved parts





- Compare two similar models, unblank only the elements that have different coordinates



Model 1

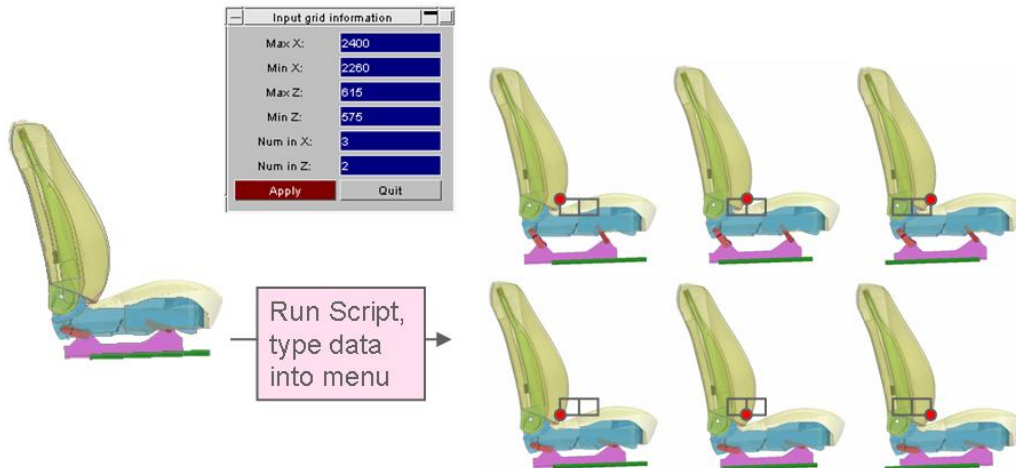
Model 2

Demo 5: Multiple seat position



- Create multiple seat models with the H-point in different positions. The script makes a menu so the user can type in data to make a rectangular grid of H-point positions.



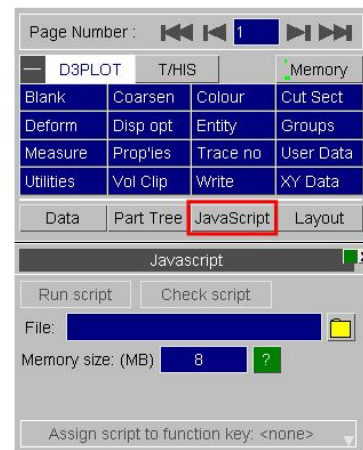
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D3PLOT Scripting




- Runs inside D3PLOT and links with it to extract data, and generate new data for plotting or output to text files.
- Special functions added by us to access data in the d3plot (ptf) files and store user-calculated data for plotting. Can also output to text file.
- Typical applications:
 - Calculate “margin against failure”
 - Code-based checking
 - User defined data
 - Extracting/combining data from many states
- We will provide example scripts and full documentation.




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D3PLOT scripting



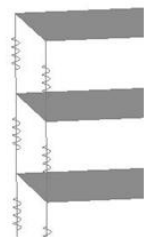
• Example 1 – calculating storey drift ratios in a seismic analysis





Drift ratio = $\delta DX / \delta Z$


Find maximum for each storey during analysis

Zero-stiffness springs used to identify storeys



D3PLOT scripting



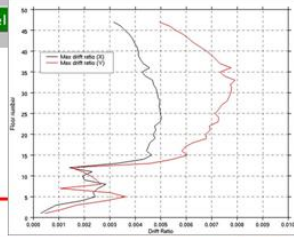
```



graph TD
    A[Loop through springs] --> B[Find storeys, remember z-coords]
    B --> C[Loop through nodes]
    C --> D[Allocate node to correct storey]
    D --> E[Loop through time-states]
    E --> F[Loop through storeys]
    F --> G[Find displacements across springs]
    G --> H[Calculate drift ratio, track maxima]
    H --> I[Loop through nodes]
    I --> J[Write storey drift as user data comp]
    J --> K[Write profile of maximum drift]
    
```

2D/3D Components

Nodal results

- Displ > Velocity > AccelIn
- Temp > User
- Solids and she > User Scalar
- Stress > Floor number
- Misc > Drift ratio X
- Thin shells on > Drift ratio Y
- Resultants > Max drift ratio X
- Solids & Tk sh > Max drift ratio Y
- Geometry > User Vector
- Part derived d > User Vector
- Energy > Velocity > Mass

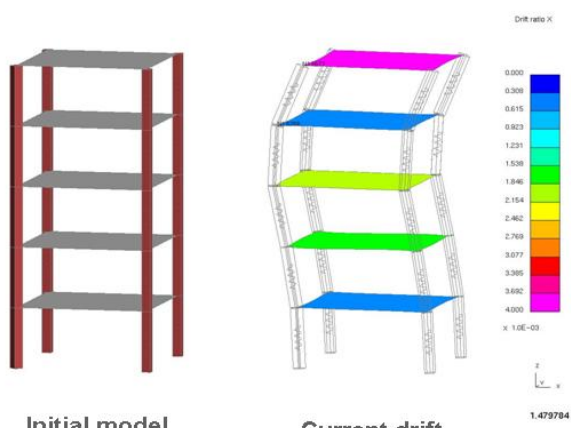


D3PLOT scripting

Oasys D3PLOT

- Sample results:

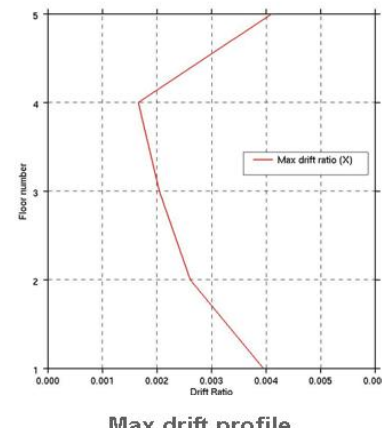


Initial model

Current drift

Drift ratio X

1.479784



Max drift profile

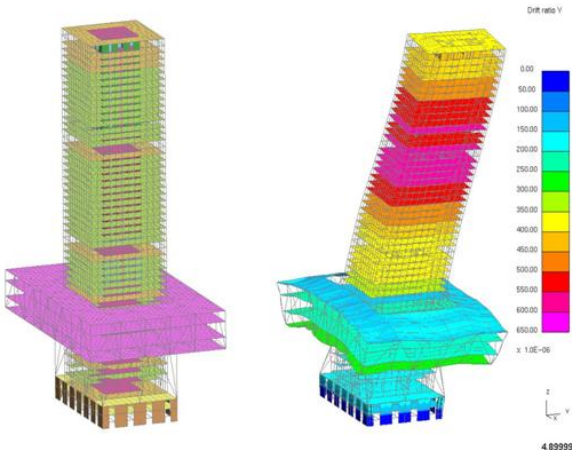
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D3PLOT scripting

Oasys D3PLOT

- The same script works on any model, provided that the springs are present to identify the storeys:

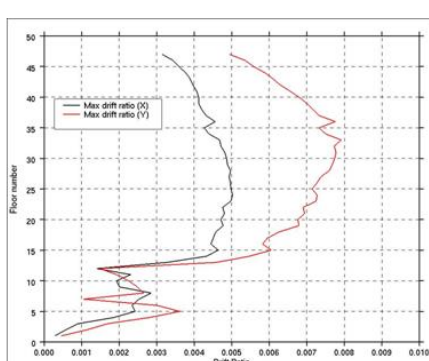


Initial model

Current drift

Drift ratio Y

4.689996



Max drift ratio (X)

Max drift ratio (Y)

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D3PLOT scripting | Oasys D3PLOT

- Example 2 - Visualising loadcell forces in full width deformable barrier.

For each block, forces on constrained nodes are written using
*DATABASE_NODAL_FORCE_GROUP

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D3PLOT scripting | Oasys D3PLOT

```

    graph TD
      subgraph T_HIS
        A[Read nodal force groups] --> B[Write CSV file]
      end
      subgraph D3PLOT
        C[Read CSV file] --> D[Loop through time-states]
        D --> E[Loop through shells]
        E --> F[Write force as user data]
      end
      B --> C
  
```

OASYS D3PLOT: Loadcell Max Force (Mid surface)

Force Value (x 1.0E+03)	Color
0.00	Blue
35.12	Cyan
70.23	Green
105.35	Light Green
140.47	Yellow-Green
175.59	Yellow
210.70	Orange
245.82	Red-Orange
280.94	Red
316.06	Magenta

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Extending Oasys PRIMER and D3PLOT

- The previous examples and demos give some idea of things that can be done with scripting in PRIMER and D3PLOT.
- Scripting makes it easy to extend the functionality of PRIMER and D3PLOT
- For example in composite models it is useful to be able to:
 - Review the ply layout in a model
 - Obtain ply information for a single LS-DYNA part
 - Obtain stresses for all plies (integration points) for a single element
- These functions can all be done using scripting...



Example extensions for composites



- Get overview and edit ply layout for all parts

The screenshot shows the Oasys PRIMER interface. On the left is a 3D model of a composite part with various colored layers. On the right is the 'Ply Layout' window, which contains a table for editing the ply layout for a part.

PART	1 2 3 4 5 6 7 8 9 10 11 12 13													Ply	Order	
	1	2	3	4	5	6	7	8	9	10	11	12	13			
Layer 1	P-1	P-1	P-1	P-1	P-1	P-1	P-1	P-1	P-1	P-1					P-1	1
Layer 2	P-2	P-2	P-2	P-2	P-2	P-2	P-2	P-2	P-2	P-2					P-2	2
Layer 3	P-3	P-3	P-3	P-3	P-3	P-3	P-3	P-3	P-3	P-3					P-3	3
Layer 4	P-4	P-4	P-4	P-4	P-4	P-4	P-4	P-4	P-4	P-4					P-4	4
Layer 5	P-5	P-5	P-5	P-5	P-5	P-5	P-5	P-5	P-5	P-5					P-5	5
Layer 6			P-7	P-7	P-12	P-12	P-12	P-12	P-12	P-7					P-6	10
Layer 7			P-8	P-8	P-13	P-13	P-13			P-8					P-7	11
Layer 8			P-9	P-14			P-14			P-9					P-8	12
Layer 9			P-10				P-15			P-10	P-10				P-9	13
Layer 10			P-11							P-11	P-11				P-10	14
Layer 11	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-6	P-11	15
Layer 12															P-12	6
															P-13	7
															P-14	8
															P-15	9



Example extensions for composites

Oasys PRIMER

- Click on a single LS-DYNA part and obtain ply information

Material (Ply) ID	Thickness	Angle
Material (Ply) ID: 1	1.00	90.0
Material (Ply) ID: 2	0.900	0.00
Material (Ply) ID: 3	1.00	45.0
Material (Ply) ID: 4	0.900	0.00
Material (Ply) ID: 5	0.900	30.0
Material (Ply) ID: 10	0.200	0.00

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Example extensions for composites

Oasys D3PLOT

- Click on a single element and obtain stresses for all plies (integration points)

Ply	Stress Value
Ply 8	-51.27
Ply 7	-38.31
Ply 6	-25.35
Ply 5	-12.39
Ply 4	0.5689
Ply 3	13.53
Ply 2	26.49
Ply 1	

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Summary and conclusions

- JavaScript is already available in Oasys REPORTER 9.2.
- JavaScript will be available in version 9.3 for Oasys PRIMER and Oasys D3PLOT.
- Scripting can be used for:
 - Creating/modifying data
 - Automating processes
 - Extending Oasys PRIMER and Oasys D3PLOT
 - Creating your own application
- More development is required. Please tell us what you need!
- Version 9.3 of Oasys software due for release in Autumn 2008.

- and finally... one last demo...



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