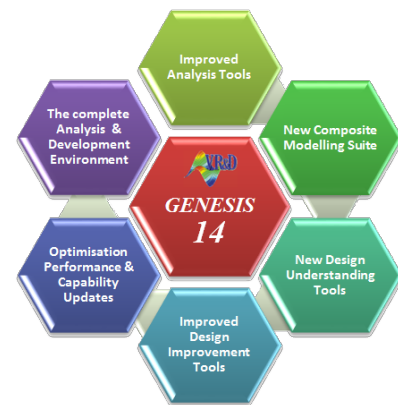


# TRUFORM NEW FEATURES (V3.0)

The following document provides a summary of the new features available in TruForm v3.0. The key updates have focussed on solve time performance, general usability of the interface and enhanced post-processing.

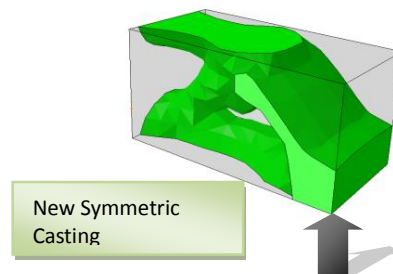
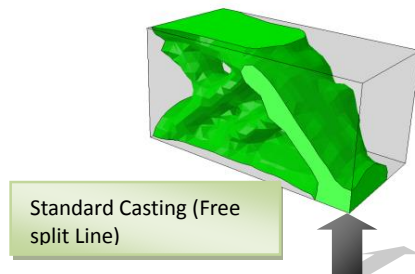
## Optimisation Enhancements

- **Genesis Solver Update** – Providing improvements in the solver performance and capabilities, TruForm v3.0 includes Genesis v14.0 which is the latest release of VR&D’s optimisation code.

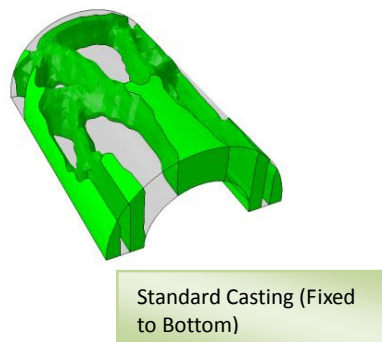


- **Additional manufacturing constraints** – Through the inclusion of Genesis v14.0, TruForm v3.0 incorporates the following additional manufacturing constraints:

- Symmetric Casting Constraint



- Radial Direction Casting Constraint



- Maximum member Size Control
- **ODB update speed-up** – Following customer feedback the performance of the ODB update stage to add Topology results to the Abaqus result database has been significantly improved. In large models it was observed that this stage could be a major bottleneck in the solution time. A new implementation of this process has been added, reducing the update time and overall solution time significantly.
- **Support of Linear Perturbation steps & Loadcases** – Significant solution time improvements can be achieved through the reduced Abaqus solve times of using linear perturbation steps and load cases, greatly reducing the turnaround time of optimisation studies. The support allows Loadcases to be considered individually in the same manner and standard Steps, supporting weighting factors and stress/strain limits.
- **Variable Stress / Plastic Strain Constraints for each Load Step / Load Case** – Following customer feedback the stress and plastic strain limits may be defined uniquely for each individual load step or load case. The enhancement allows both durability and abuse load cases to be effectively considered in a single Topology optimisation study.

To apply individual stress or plastic strain limits, the user must change to ‘Chosen Loads’ in the Load Steps section of the TruForm set-up. Selecting the loads to consider and shifting them to the ‘Selected Loads’ column then allows the stress or strain to be defined for each case.



Load Steps

All Load Steps  Allow Plasticity & nlgeom

Chosen Loads:

Selected Loads	Weighting	Stress	Available Loads
1 Pert-Step:Braking	1.0	120	3
2 Pert-Step:Bump_Abuse	1.0	250	4
3 Pert-Step:Bump_Fatigue	1.0	120	5
4 Pert-Step:Cornering	1.0	95	6

- **Support of more than 100 iterations** – For Plastic Strain based optimisation studies it was observed that, in some cases, the total number of Genesis iterations may exceed 100, causing inconsistent reporting of the Topology optimisation results in the Abaqus ODB file. V3.0 has been updated to support more than 100 design iterations.
- **Support of sub-structure files on cluster solves** – For models including sub-structures as included data the user may now provide a list of the referenced sub-structure files in the abgen.data file. Sub-structure filenames should be included in the abgen.data file under the keyword SUBSTRUCTURE, comma separated as shown in the example below:
  - SUBSTRUCTURE=substructure1.sup,subfile2.sup

## Pre & Post-Processing Enhancements

- **Filtering of available SECTION data** – When selecting the section to optimise within TruForm the UI has been enhanced to filter sections based upon the model and instance selected. For large scale models this greatly simplifies section picking and eliminates a possible source of error during optimisation set-up
- **Refined Mass Fraction Selection** – When selecting the allowable mass fraction for a design region the UI has been updated to allow the user to select values at a more refined level. Version 2.0 allowed increments of 10% (0.1) and in version 3.0 this has been updated to allow 1% increments (0.01) in the allowable mass fraction
- **Selection of Datum Coordinate System for Local Manufacturing Constraint Direction** – Simplifying the optimisation set-up for non-standard model orientations, v3.0 allows users to directly select datum coordinate systems via the UI. This eliminates the need for the user to manually specify the local coordinate attributes.



Manufacturing Co-ordinate System: Local ▾

Origin: X  Y  Z

Point on Z-Axis: X  Y  Z

Point on XZ Plane: X  Y  Z

**TruForm v2.0 Local Coordinate Definition**



Manufacturing Co-ordinate System: Local ▾ Datum csys-1 ▾

**TruForm v3.0 Local Coordinate Selection**

- **Selection of viewport to load results** – When loading TruForm Topology results into Abaqus/CAE the post-processing menu has been updated to allow users to select the viewport in which to load results. Optionally, users may define a new viewport name to be created.



Viewports

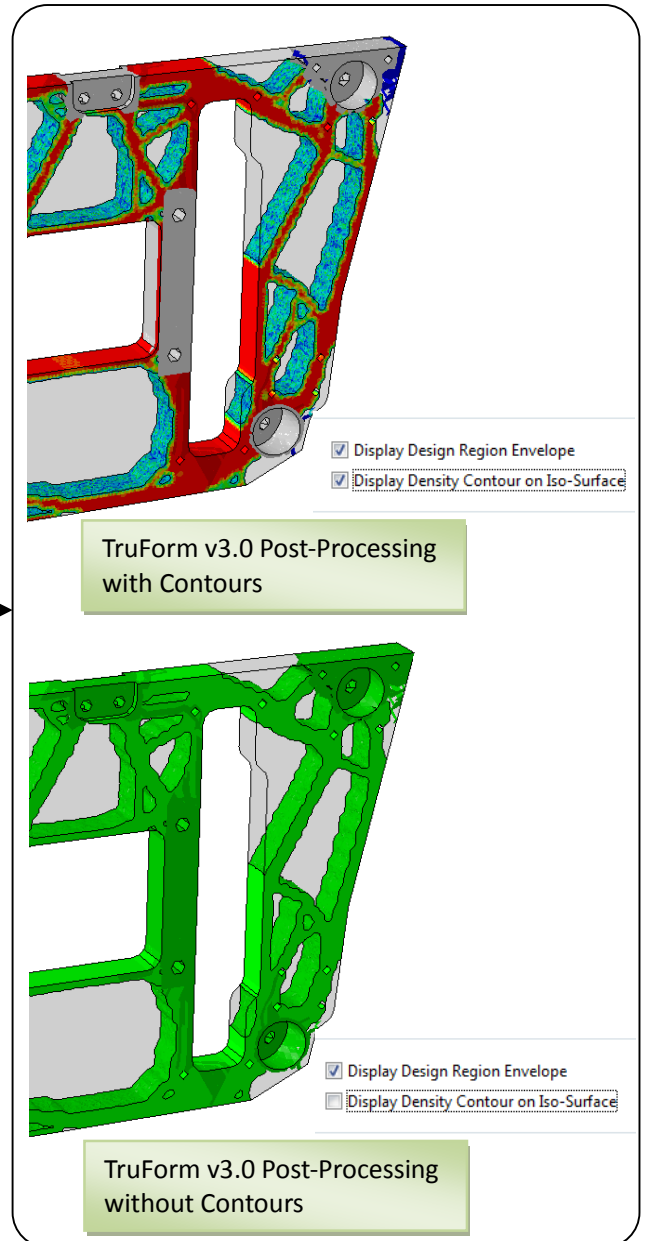
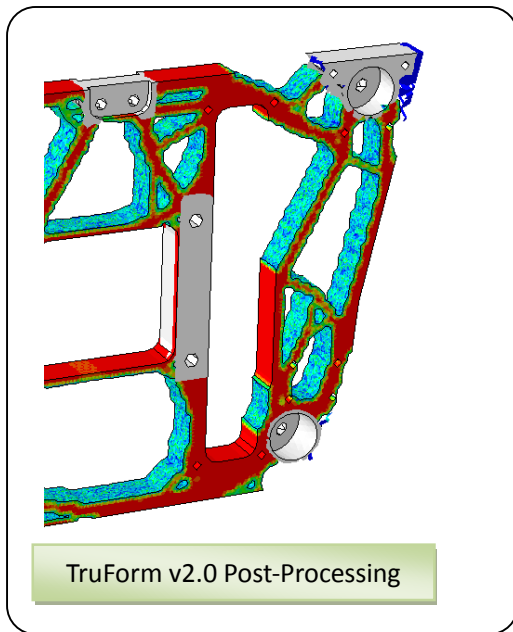
Current Viewport

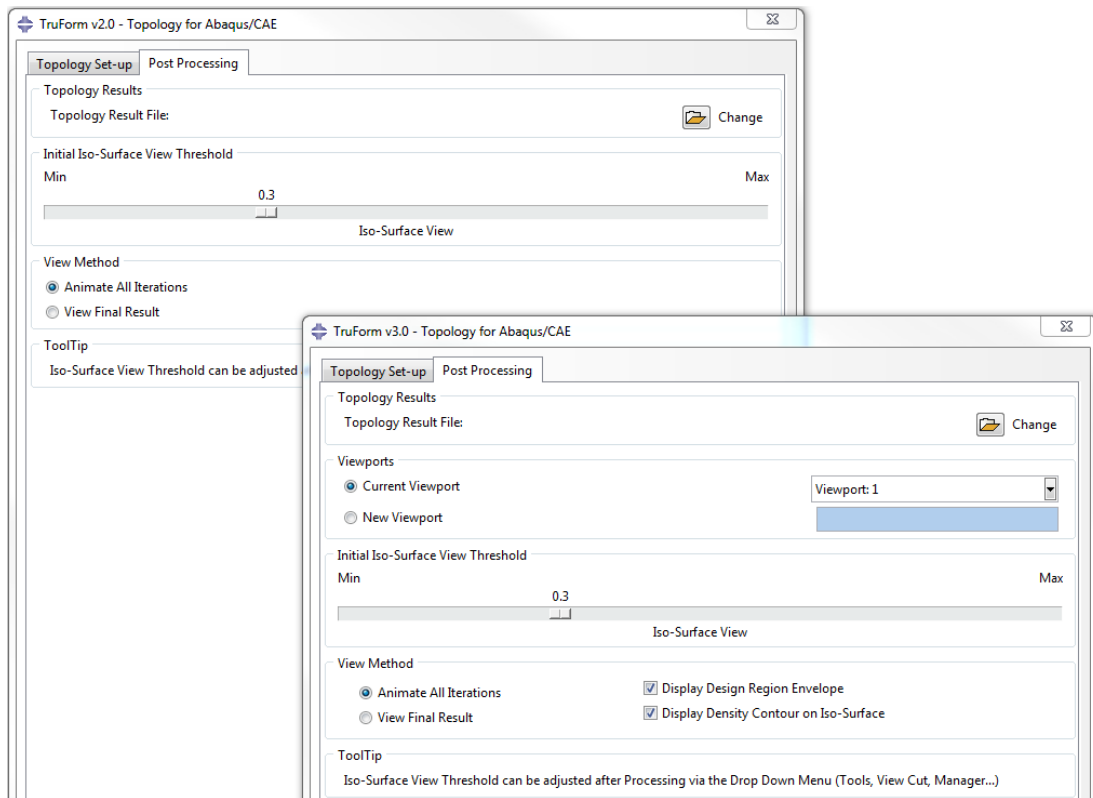
New Viewport

Viewport: 1 ▾

TruForm\_PostProcessing

- **Display of design space envelope** – When post-processing TruForm results the initial design envelope will be plotted as a transparent region over the Topology results. This allows clearer identification of where material has been removed from the design region.
- **Display of Topology Densities on Iso-Surface Results** – When post-processing TruForm results the user may now select whether the iso-surface results are plotted with or without the element densities as a contour.





**Comparison of TruForm v2.0 and v3.0 Post-Processing Interface**