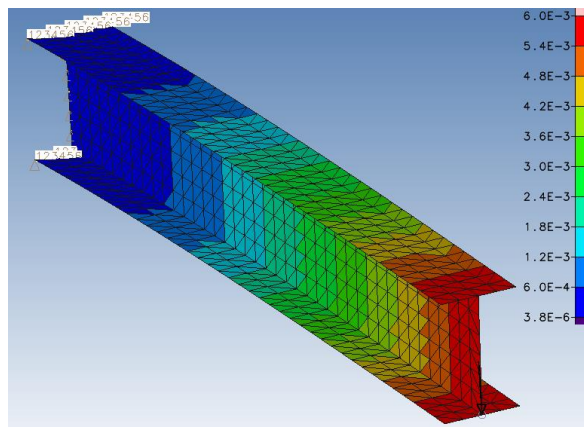
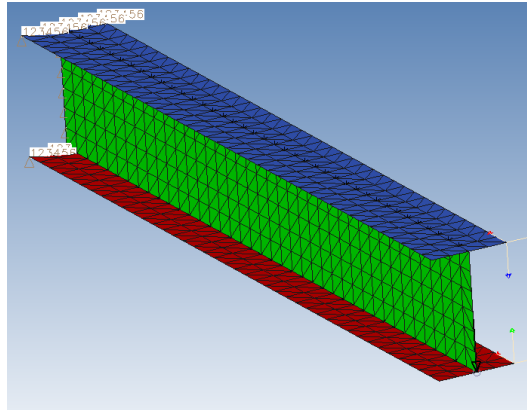


Shape Optimisation

The below picture shows an cantilever I beam (200mm long, 32mm deep by 20mm wide with a wall thickness of 2mm) fixed in 6 dofs at the wall with a u.d.l. of 50kN/m (total load on the beam is 10kN). Solve this model to see the current deflection.



The purpose of this analysis is to change the shape of the I-beam by altering the height of the beam to obtain a maximum deflection of 5mm.

Hence

- Objective is to minimise mass (have the lightest possible beam)
- Variable is the height of the I beam
- Constraint is that y_{max} is 5mm.

First set up your objective

The screenshot shows the 'Edit Design Objective' dialog box in a software application. The dialog has a title bar with standard window controls. Below the title bar is a toolbar with icons for 'Display', 'Analysis', 'Topology', 'Design', 'Post', and 'Plugins'. The 'Design' tab is selected. The main area is titled 'Edit Design Objective : Enter Name and Type'. It contains a 'Name' field with the text 'D61'. Below this is a 'Response Type' section with a list of radio buttons: 'Mass' (selected), 'Volume', 'Strain Energy', 'Displacement', 'Stress', 'Grid Stress', 'Failure Index', 'Buckling Load Factor', 'Frequency Mode Number', 'Synthetic Response', and 'More Response Types...'. To the right of these radio buttons are three dropdown menus: 'Entire Model', 'Entire Model', and 'Selected Groups'. Below the 'Response Type' section is an 'Objective Definition Switch' section with radio buttons for 'Max', 'Min' (selected), and 'Target'. To the right of these radio buttons are two input fields: '0.0' and '1.0'. At the bottom of the dialog is a 'Comments' text area. The status bar at the bottom of the window shows 'Making New Data' and the date '33/10/2016'.

Display Analysis Topology Design Post Plugins

Objectives

< Back Next > Finish Cancel

Edit Design Objective : Enter Name and Type

Name: D61

Response Type

☒ Mass ☐ Volume ☐ Strain Energy ☐ Displacement ☐ Stress ☐ Grid Stress ☐ Failure Index ☐ Buckling Load Factor ☐ Frequency Mode Number ☐ Synthetic Response ☐ More Response Types...

Objective Definition Switch

☐ Max ☒ Min ☐ Target

Weight: 1.0

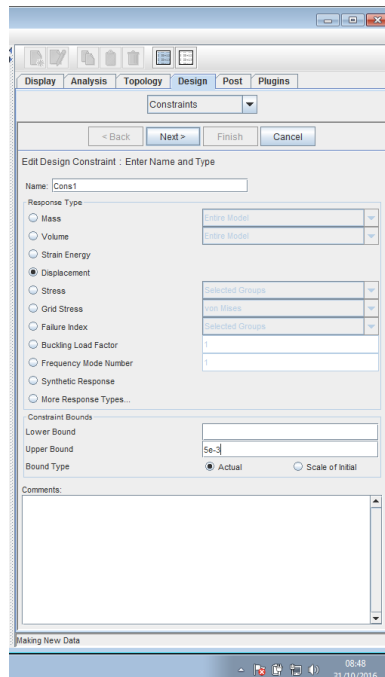
Comments:

Making New Data

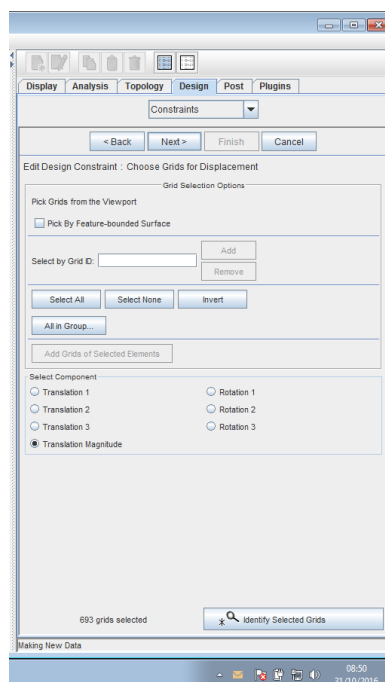
08:46 33/10/2016

Then set up your constraint

Displacement constraint>upper bound of $5e-3$ >Next



Select all>translation magnitude>Next

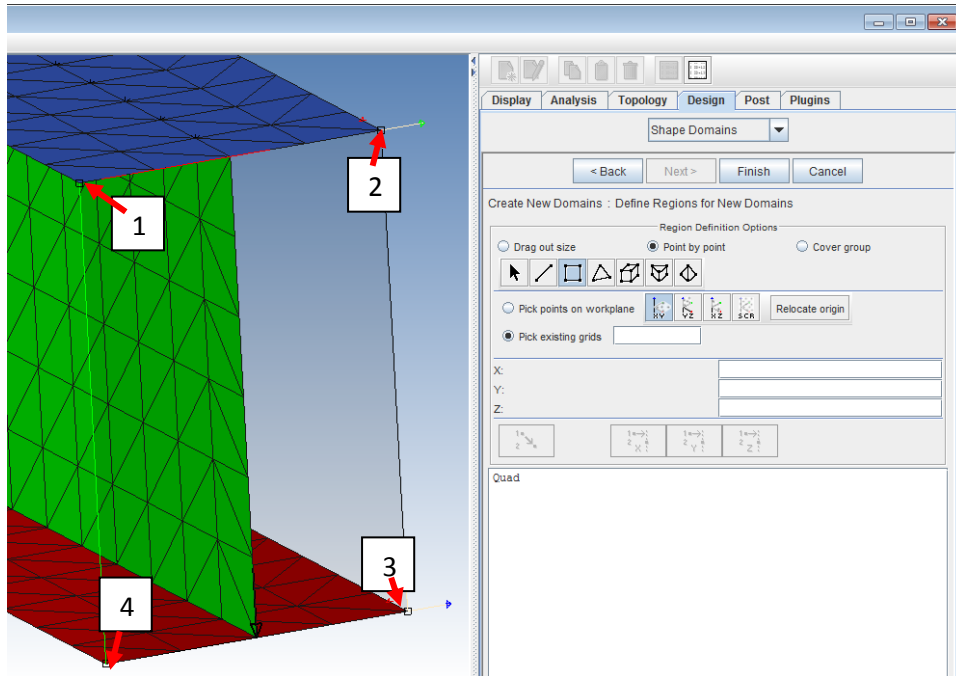


Select your loadcase>finish.

Next we will set up the variable. First we must define a 'shape domain'

Design>shape domain>new>new domains quick setup>Next>choose your group>next

Point by point>quad>existing grid>choose the four nodes shown below

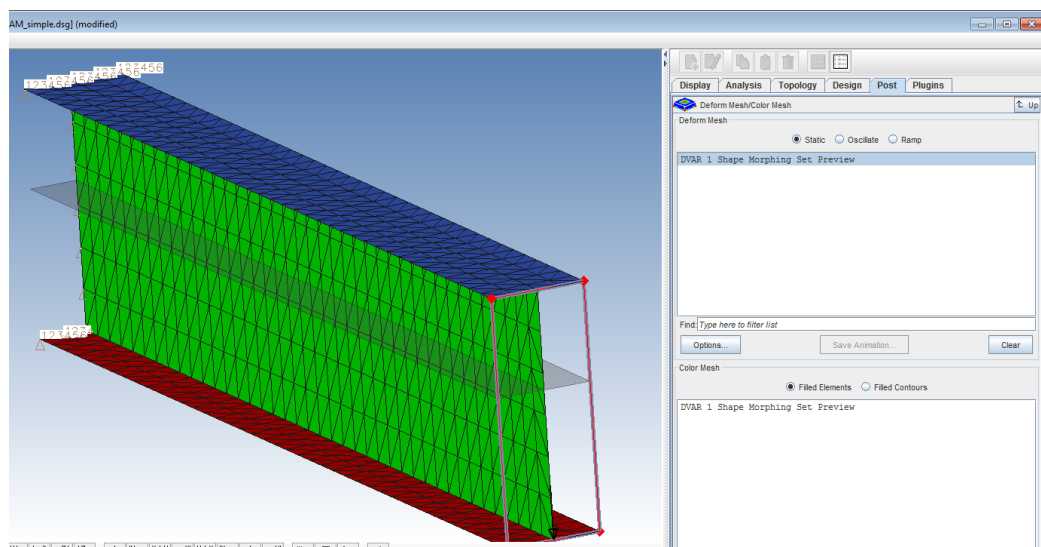


Finish

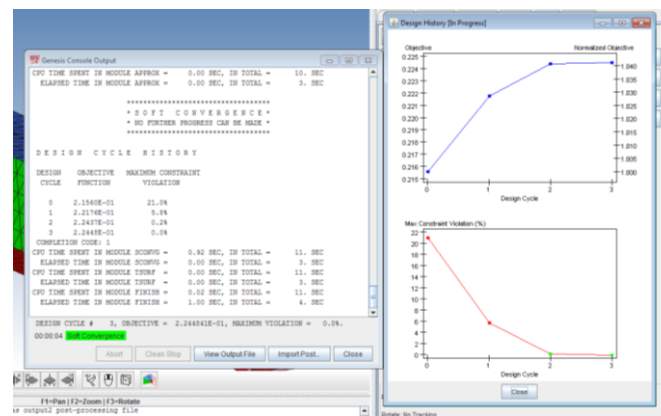
Now we must go into 'shape morphing sets'

Design>shape morphing sets>new>domain morphing set>next>choose your domain that you have just defined>next>Choose nodes 1 and 2 above>choose direction by 2 grids>choose nodes 3 then 2 above>next>set the magnitude to 20e-3>add perturbation>finish

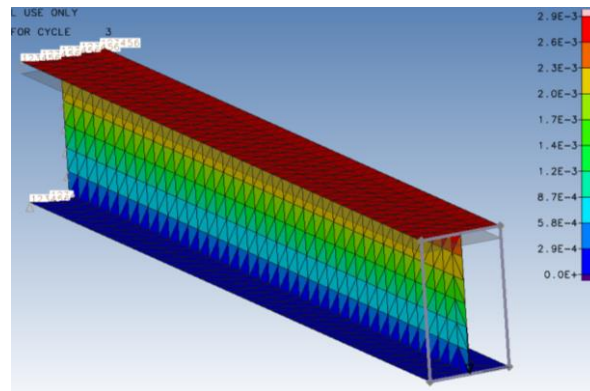
Note that if you go into post you can visualise this morphed domain.



Now optimise this structure;



Read your results in and you should be able to see that the height of the beam has been raised by 2.9mm



Giving you a displacement of 4.9mm

