

## **Standard Deviation Plot.vbs**

### **Description**

This script determines the averaged nodal value for Standard Deviation in unaveraged nodal values for the visible model, active loadcase, specified results entity and specified results component. The Standard Deviation divided by maximum absolute unaveraged nodal value is also determined. These results can then be used for mesh refinement studies as a means of assessing the suitability of the sizes and of the number of elements, the interpolation order of elements used and the elements' shapes.

A Contour plot of the standard deviation in unaveraged nodal results can be used qualitatively to identify areas where the mesh should be refined as well as quantitatively to determine the degree of error in the averaged nodal results. It may also serve as a QA plot as part of validating the mesh used. A plot would thus show blue for suitably refined areas and red for the areas most needing refinement (with a suitable Contour range set). The maximum standard deviation above which refinement would be required can be decided and checked against. The user would also need to set suitable parts of the model visible to limit results plotted and averaged. Plotting the SD divided by the averaged nodal value may also allow singularities to be identified.

Plotting unsmoothed contours is currently a good check for the mesh, but this is only visual and does not quantify or qualify the mesh as being refined suitably for the user's purpose.

### **Example Calculation:**

4 unaveraged nodal values, of S1 for example, 85 N/mm<sup>2</sup>, 90 N/mm<sup>2</sup>, 100 N/mm<sup>2</sup>, and 125 N/mm<sup>2</sup> are averaged as 100 at a node.

$SD = \sqrt{(15^2 + 10^2 + 0^2 + 25^2)/4}$  therefore  $SD = 15.4 \text{ N/mm}^2$

SD divided by the averaged nodal value = 0.154

### **Notes**

1. THIS SCRIPT IS NOT PART OF LUSAS SOFTWARE AND AS SUCH IS NOT QUALITY APPROVED OR SUPPORTED. IT IS PROVIDED ON AN AS IS BASIS FOR DEMONSTRATION PURPOSES ONLY.
2. This script is intended for use with plane stress, plane strain, plate, shell and volume elements and will not work with all elements.
3. The script cannot be used for composite lamina results.
4. The results created will be found under the entity 'User Results'.
5. The results can be used for averaged values and smoothed plots only. There are lines commented out in the script that will also enable unaveraged nodal values and unsmoothed plots if required, but this can take considerable time for the script to calculate.
6. For very large numbers of visible elements, the script may take some time to run. The script can be stopped by pressing Ctrl+Break on your keyboard.