

Sensitivity Analysis



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Principles for sensitivity analysis

Sensitivity analysis is where the effects of different features/parameters values are investigated. This can prove very useful in promoting better understanding of the behaviour of systems being modelled. For example, if the results are not sensitive to the value of a particular parameter this can help to validate the model and provide information which can help in the design. If the results are sensitive to a parameter then special validation action may be needed.

The need for sensitivity analysis is a function of the degree of uncertainty about the behaviour. When working on an unusual system, sensitivity analysis may be essential.

The following issues are relevant to sensitivity analysis

- A useful strategy is to work from a *reference model* changing one variable at a time reverting to the reference model after each change. As one gains understanding it may be better to change the reference model but if the changes are compounded it becomes difficult to make sensible comparisons. See the example of a sensitivity analysis in the modelling review in Section 12.1.6.
- Make comparisons with *indicative parameters* i.e. parameters which tend to exemplify the behaviour. Typical indicative parameters are:
 - * maximum deflection in the direction of the main loading
 - * the deflection in the line of a single point load used as a checking loadcase
 - * the maximum bending moment, shear force, axial force or torque in the system
 - * the value of the lowest natural frequency
- In the report for the sensitivity analysis, show the corresponding results as close to each other as practicable - on the same table or on the same graph.
- Make the results non-dimensional. Quote percent changes or ratios of the values to that from the reference model - see for example, Section 12.1.6 Make the independent variables non-dimensional if practical.

Examples:

Vierendeel frame model - see Section 12.1.7 at:

<http://www.imacleod.com/UsingStructM/example-book.pdf>

Bridge truss: <http://www.imacleod.com/UsingStructM/Bridge-truss.docx>