LS-OPT Capabilities for Robust Design

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Abstract

This paper presents a number of new features available in LS-OPT Version 2.2. As a step toward robust design, the code has been extended to enable reliability assessment and the identification of sources of unpredictability in the FE model. In the latter feature, deterministic and stochastic effects can be separated.

Reliability Assessment

To enhance the Probabilistic Analysis capabilities for command line input in Version 2.1, Version 2.2 now allows input via the graphical user interface. The features enable the investigation of stochastic effects using Monte Carlo simulation involving either direct FE Analysis or the analysis of Surrogate Models such as Response Surface Methodology or Neural Networks. As an input distribution, any of a series of statistical distributions such as Normal, Uniform, Beta, Weibull or User-defined can be specified. Latin Hypercube sampling provides an efficient way of implementing the input distribution. Histograms and influence plots are available through the postprocessor.

Identifying sources of Instability on the FE model:
Distinguishing between Deterministic and Random response

Some structural problems may not be well-behaved i.e. a small change in an input parameter may cause a large change in results.

LS-OPT Version 2.2 computes various statistics of the displacement and history data for viewing in the LS-DYNA FE model postprocessor (LS-PREPOST). The methodology differentiates between changes in results due to design variable changes and those due to structural instabilities (buckling) and numerical instabilities (lack of convergence or round-off). Viewing these results in LS-PREPOST allows the engineer to pinpoint the source of instability on the FE model for any chosen response. This feature enables her to address instabilities that adversely affect predictability of the results.

Selected Usability Features

- Identification of variable definitions in input files for LS-DYNA and selected pre-processors. The variable names are automatically displayed in the GUI.
- Interfaces for standard pre-processor packages have been added for shape optimization.