AUTOMATED MULTILEVEL SUBSTRUCTURING: ISSUES IN LARGE-SCALE VIBRATION ANALYSIS

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Automated multilevel substructuring (AMLS) has recently become a standard technique for performing large-scale vibration analysis in the automotive industry. In AMLS, typically a multimillion degree of freedom finite element (FE) discretization is subdivided into ten thousand or more substructures on more than twenty levels. The finite element representation is transformed into one in terms of substructure eigenvectors. Modes of the entire structure are approximated in terms of substructure eigenvectors so that frequency response analysis can be performed.

When AMLS was introduced to the automotive industry two years ago, vibration analysis was limited by the capabilities of the Lanczos eigensolver on available hardware. Since AMLS has come into widespread use, the dimension of FE discretizations of car bodies has doubled, allowing accurate analyses to be performed to much higher frequencies. As a result, the number of modes involved in the analysis has increased greatly. Operations that had been minor parts of the overall analysis process have become much more prominent, necessitating development of special algorithms.

This talk will present an overview of large-scale vibration analysis using AMLS, focusing on issues that have become more important as AMLS has enabled analysis to be done at higher frequencies.