IMPROVING EFFICIENCY OF ACMS AND AMLS DOMAIN DECOMPOSITION METHODS FOR LARGE VIBRATORY SYSTEMS USING RE-ANALYSIS CONCEPTS

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ABSTRACT –
For structural dynamics problems, optimization of large-scale finite element (FE) models can be prohibitively expensive because it requires repeated FE analyses. We have developed and demonstrated in previous conferences, various single-level re-analysis methods such as the Parametric Reduced-Order Modelling (PROM), the Combined Approximations (CA), and the Modified Combined Approximations (MCA), for gauge (thickness), shape, and topology changes with the premise to effectively calculate the dynamic response of a structure after a baseline design has been modified, without recalculating the new response. In this presentation, we will build on previous developments. We will present computationally efficient substructuring methods using re-analysis for multi-level Craig-Bampton CMS (Component Mode Synthesis) with interface modes. The developed methods improve the efficiency of the currently available ACMS (Automated Component Mode Synthesis) and AMLS (Automated Multi-Level Substructuring) multi-domain methods for both global and local changes. Preliminary results indicate that the proposed multi-level substructuring method with re-analysis can be 3-5 times faster than ACMS. Both the ACMS and AMLS are essentially multi-level fixed interface Craig-Bampton methods. The only difference between them is that ACMS uses a binary partition tree, while AMLS uses a more general partition tree. An example using a large-scale vehicle finite-element model, will demonstrate all developments. The proposed approach can provide substantial computational savings in optimization and NVH studies of large vibratory systems.