A SUBSTRUCTURING REDUCTION METHOD IN ROTOR DYNAMIC ANALYSIS

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ABSTRACT

Rotor dynamics is a very important component of structural analysis with applications ranging from the transportation to the energy industries. The computational cost of computing critical speeds and stability, as well as the dynamic responses of rotating structures is significant hence reduction approaches are frequently used.

Modal reduction technique projects the problem into modal space and performs analysis on the reduced problem, then projects the results back into physical space for subsequent post processing. This method is widely used in industry with real modes and has been applied in various response analyses to achieve a tremendous reduction in computation time, but its accuracy is limited.

In this presentation, we introduce a novel method which significantly increases the efficiency in direct complex frequency, frequency response, and transient response analysis in rotor dynamics. In this method, we define a sub-structure reduction partition for each rotor that is reduced by either real or complex eigenvalue solution. Then the original problem is redefined by this modal space and the retained partition into an analysis problem. Typically, the retained partition includes the node points that connect the rotor to the supporting structure and the node points where active loads (for example such like simulating mass imbalance) are applied.

The presentation will demonstrate how this reduction method improves efficiency along with accuracy in an NX Nastran industrial case study.