Preface

Dynamics of Coupled Structures represents one of ten volumes of technical papers presented at the 35th IMAC, A Conference and Exposition on Structural Dynamics, organized by the Society for Experimental Mechanics and held in Garden Grove, California, January 30–February 2, 2017. The full proceedings also include the following volumes: *Nonlinear Dynamics*; *Dynamics of Civil Structures*; *Model Validation and Uncertainty Quantification*; *Sensors and Instrumentation*; *Special Topics in Structural Dynamics*; *Structural Health Monitoring and Damage Detection*; *Rotating Machinery, Hybrid Test Methods, Vibro-Acoustics, and Laser Vibrometry*; *Shock and Vibration, Aircraft/Aerospace, and Energy Harvesting*; and *Topics in Modal Analysis and Testing*.

Each collection presents early findings from experimental and computational investigations on an important area within structural dynamics. Coupled structures or substructuring is one of these areas.

Substructuring is a general paradigm in engineering dynamics where a complicated system is analyzed by considering the dynamic interactions between subcomponents. In numerical simulations, substructuring allows one to reduce the complexity of parts of the system in order to construct a computationally efficient model of the assembled system. A subcomponent model can also be derived experimentally, allowing one to predict the dynamic behavior of an assembly by combining experimentally and/or analytically derived models. This can be advantageous for subcomponents that are expensive or difficult to model analytically. Substructuring can also be used to couple numerical simulation with real-time testing of components. Such approaches are known as hardware-in-the-loop or hybrid testing.

Whether experimental or numerical, all substructuring approaches have a common basis, namely, the equilibrium of the substructures under the action of the applied and interface forces and the compatibility of displacements at the interfaces of the subcomponents. Experimental substructuring requires special care in the way the measurements are obtained and processed in order to assure that measurement inaccuracies and noise do not invalidate the results. In numerical approaches, the fundamental quest is the efficient computation of reduced order models describing the substructure's dynamic motion. For hardware-in-the-loop applications, difficulties include the fast computation of the numerical components and the proper sensing and actuation of the hardware component. Recent advances in experimental techniques, sensor/actuator technologies, novel numerical methods, and parallel computing have rekindled interest in substructuring in recent years leading to new insights and improved experimental and analytical techniques.

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