ALGORITHMS FOR MASSIVELY PARALLEL STRUCTURAL ACOUSTICS

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A continuing effort at Sandia involves the development of complementary experimental and massively parallel numerical simulation capabilities for small-scale (MEMS) and large-scale (vibroacoustic) structural acoustic analysis. This presentation will focus on the numerical issues. A parallelization scheme has been developed that allows for arbitrary decomposition of the wet interface, allowing the wet interface to fall either within (intra) on between (inter) the subdomain boundaries. This allows for general domain decompositions. A scaling procedure will also be presented which helps to reduce the poor condition numbers resulting from property mismatch between fluid and solid. Two formulations for the fluid will be considered: a standard velocity potential formulation, and a viscous vector formulation. In the former approach, the research issues are mainly in the massively parallel implementation, while in the latter approach, they are in the mathematical formulation of problem. An acoustic formulation with viscosity is necessary to model shear wave radiation damping of structures, which is typically a significant damping mechanism in MEMS. The acoustical formulations have been coupled with Salinas, a massively parallel structural dynamics code. Salinas, with the underlying FETI solver, has recently shown scalability to thousands of processors, making it a unique simulation framework for large-scale structural analysis. The mathematical formulation of the problem and numerical results of large-scale structural acoustic analysis will be presented.

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