

Abstract Submitted
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Hybrid Adaptive Wavelet Collocation – Brinkman Penalization – Ffowcs Williams and Hawkings Method for Compressible Flow Simulation and Far-Field Acoustics Prediction¹ QIANLONG LIU, OLEG V. VASILYEV, University of Colorado at Boulder — One of the most practically important problems of computational aero-acoustics is the efficient and accurate calculation of flows around solid obstacles of arbitrary surfaces. To simulate flows in complex domains, we combine two mathematical approaches, the Adaptive Wavelet Collocation Method, which tackles the problem of efficiently resolving localized flow structures in complicated geometries, and the Brinkman Penalization Method, which addresses the problems of efficiently implementing arbitrary complex solid boundaries. Through them, we can resolve and automatically track all the important flow structures on the computational grid that automatically adapts to the solution. To obtain accurate long-time flow simulation and accurately predict far-field acoustics using a relatively small computational domain, appropriate artificial boundary conditions are critical to minimize the contamination by the otherwise reflected spurious waves. Once the near-field accurate simulation is available, Ffowcs Williams and Hawkings (FWH) equations are used to predict the far-field acoustics. The method is applied to a number of acoustics benchmark problems and the results are compared with both the exact and the direct numerical simulation solutions.

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