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Assessment of methodologies for the solution of the Ffowcs Williams and Hawkings equation using LES of incompressible single-phase flow around bluff bodies[1] VINCENZO ARMENIO, MARTA CIANFERRA, University of Trieste, SANDRO IANNIELLO, CNR-INSEAN, Marine Technology Research Institute — The Ffowcs Williams and Hawkings (FW-H) equation is used for the prediction hydrodynamic noise. We first derive the convective formulation of the volume terms of the FW-H equation. Successively, different solution strategies of the FW-H equation are evaluated using a fluid dynamic dataset obtained through large eddy simulation of a turbulent flow around a finite cylinder with square section. Specifically, the fluid dynamic noise is computed by a simple linear (Curle) approach, by the porous formulation, through direct volume integration of the nonlinear noise sources and using combination of porous and volume integration. The analysis allows to point out the strengths and drawback of the different techniques and to achieve, through the comparison of the different solutions, an accurate understanding of the noise source mechanisms taking place in the flow. Finally, we analyze the hydrodynamic noise generated by three simple, still significant, bluff bodies, namely a cube, a sphere and a prolate spheroid. The analysis shows that a streamlined body is able to produce a pressure signal one order of magnitude lower than a bluff geometry. Also, the presence of sharp corners enhances the acoustic field both in amplitude and in frequencies.

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