Numerical and Experimental Analysis of Sound Generated by an Orifice

The present paper deals with noise produced by an orifice placed in a circular duct. Such noise is mainly generated by the orifice itself and by the unsteady flow and turbulence in the orifice wake. The main objective of the present work is to develop a numerical prediction tool for the acoustic energy level produced by the orifice placed in a ducted flow. The model is based on the solution of the Navier-Stokes equations, for the compressible turbulent flow, inside the duct and in the near-region outside the duct termination, and on the Ffowcs Williams-Hawkings surface method for the evaluation of the far-field acoustic radiation. Experimental measurements were also performed; such data are used to validate the numerical model. The measured and computed sound pressure level directivities are in good agreement, and show the influence of the orifice on sound generation. The numerical results are in good agreement with the law, relating the fluctuating drag force acting on the orifice and the steady drag force, proposed in the theory of Nelson and Morfey.

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