Prediction of noise generated by complex flows at low Mach number\textsuperscript{1} YASER KHALIGHI, ALI MANI, PARVIZ MOIN, Center for Turbulence Research, Stanford University, Stanford, CA, 94305 — We present a computational aero-acoustics method to evaluate noise generated by low Mach number flow over complex configurations. This method is a hybrid approach which uses Lighthill’s acoustic analogy in conjunction with source-data from an incompressible calculation. Scattering of sound waves are computed using a Boundary Element Method. This approach can be applied to flow configurations with practical complexities where turbulence interacts with arbitrary shaped solid objects. We present a validation study for sound generated by flow over a circular cylinder at $Re = 100$ and $Re = 10000$. The hybrid method is validated against directly computed noise using a high order compressible flow solver as well as solution of the Ffowcs Williams-Hawkings equation in conjunction with compressible noise sources. We concluded that the noise predicted by a 2\textsuperscript{nd} order hybrid approach is as accurate as directly computed noise by a 6\textsuperscript{th} order compressible flow solver in the low frequency range where the low order numerics can accurately resolve the flow structures.

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