Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Sound produced by subcritical Reynolds number cylinder flow[1]
ZANE NITZKORSKI, KRISHNAN MAHESH, Univ of Minn - Minneapolis — Sound production from cylinders has been studied due to their canonical application to investigating bluff body flow noise. The effect of Reynolds number for circular cylinders for Re=3900, 10000, and 89000 are investigated with the resulting impact on the noise generation process. The physics of noise production are investigated and a model for understanding the source and direction of noise propagation is presented. The acoustic solution is calculated from a novel porous Ffowcs-Williams and Hawkings acoustic analogy which is described and allows for investigating the scattered and incident acoustic fields by separating volume contributions from the total noise. The volume source terms are correlated over multiple planes to obtain a convection velocity that is then used to determine a corrective convective flux at the FW-H porous surface. The hydrodynamic fields are validated and the computed sound is compared with experiments. The effect of spanwise coherence and its effect on the physics of sound production is discussed. For the highest Reynolds number case, a dynamic mode decomposition is performed on the acoustic sources to demonstrate their spatial distribution and net effect.

[1]Supported by Office of Naval research

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Date submitted: 30 Jul 2015 Electronic form version 1.4