# NUMERICAL SIMULATION OF ACOUSTICS IN HETEROGENEOUS MEDIA

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ABSTRACT

Nowadays sound and noise control is an important topic in science as well as in many industrial branches. It is crucial to know formation mechanisms to understand the sound emission phenomena. Even today basic questions like sound appearance caused by multiphase flows are still open. These questions have to be answered to gain progress in basic research of acoustics, noise and sound.

Within this contribution a coupled numerical solver for the acoustics of multiphase flows is presented. The approach follows the so called *Expansion about Incompressible Flow* (EIF) by Hardin and Pope [1]. The incompressible flow solver is based on the finite-volume method and computes two-phase flows via an interface capturing volume-of-fluid method. Acoustic computations are based on the linearized Euler equations. Special care has to be taken in treating heterogeneous media, because of the jump of the material properties [2]. The procedure is based on a one-way-coupling, i.e. it is assumed that the sound is generated by pressure fluctuations, but the flow is not influenced by the transported sound wave. This assumption is justified when there are high differences in the transported energy. For example, a sound wave in air transports much less energy than a water wave, so the water wave will not be influenced by the sound wave.

The coupled code is verified for a sound wave that runs through a heterogeneous media domain and is partly reflected at the interface. The speed of sound and the transmitted pressure are investigated. For the sound emission due to multiphase flows the drop impact in a fluid pool is considered. In particular, the issue of the complicated curvature definition due to the use of the volume-fraction function is addressed. The results lay the foundation for a complex sound emitting multiphase test case.

REFERENCES

[1] J. Hardin and D. Pope. An Acoustic/Viscous Splitting Technique for Computational Aeroacoustics. Theoretical and Computational Fluid Dynamics, 6:323–340, 1994

[2] R. J. LeVeque. Finite-Volume Methods for Hyperbolic Problems. Cambridge University Press, 2004.