How to add a simple acoustic analogy to OpenFOAM

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Training type: Advanced

Session type: Hands-on

Software stack:

- OpenFOAM 3.0.x

Developers of this session:

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Development team website: https://github.com/unicfdlab

Full description

The reducing of noise level in aerospace, aviation, marine and automobile industries is an actual task. The different numerical methods are used for noise prediction in computational aeroacoustics. Among them are direct noise computation, finite difference method, discontinuous Galerkin method, linearized Euler equations, finite volume method with hybrid RANS-LES approaches and acoustic analogies. The main acoustic analogies (Lighthill's, Curle's and Ffowcs Williams-Hawkings) are well described in literature. There are a lot of benchmark tests (cylinder, tandem cylinders, rod-airfoil, cavity, etc.) which have a detailed experiment data (PIV results, frequency, Sound Pressure Level) in a near and far fields.

The module will start with a short introduction to computational aeroacoustics, examples, acoustic analogies and Fast Fourier Transform algorithm to perform transfer data from time to frequency domain. We will do an examination of prepared source code - library with a simple acoustic analogy (Curle's analogy), FFTW code and mechanism of functionObject API in OpenFOAM. We will run the "tandem cylinders" tutorial, do analysis of results (drag coefficient, pressure fluctuations for an observer, frequency, Strouhal number, SPL). The attention will be paid on a choice of numerical schemes, turbulence model and grid's resolution.

The attendees will require good knowledge of setting up cases, running/modifying tutorial cases as well as a basic understanding of programming/compiling source code.

This module will be hands-on. The attendees will require a laptop with a current OpenFOAM installation or - preferably - be able to boot the conference USB stick.