Acoustic and Aeroacoustic investigation of a three-dimensional rotor model

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Computing the flow induced sound in rotating systems such as in ventilators and compressors yields additional challenges compared to setups without moving parts. In our contribution we apply a newly developed, hybrid computational scheme to a three-dimensional geometry, consisting of two rotating discs connected with a shaft and two eccentric cylinders in a quiescent medium. The dominant sound producing phenomenon in this setup is the vortex shedding at the individual cylinders as well as the interaction between them.

Initially the geometry is acoustically investigated for eigenmodes and radiation patterns. For the aeroacoustics the flow is computed by solving the incompressible Navier- Stokes (NS) equations using ANSYS Fluent on an unstructured grid with sliding interface. Due to an energy conserving interpolation scheme, it is possible to use a specially adapted computational grid for the acoustic calculation to increase computational efficiency. The sound propagation is computed by solving the acoustic wave equation by the Finite-Element (FE) solver CFS++, which uses a Nitsche type mortaring to couple rotating and stationary mesh. The results are compared with a semi analytical solution.