FMRC Fluid Mechanics Research Seminar Series

Reduction of Turbomachinery Fan Noise

Esra Sorgüven
Yeditepe University

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Abstract: Reduction of turbomachinery noise is one of the main research topics in a variety of technical fields, especially in household appliances. Computational methods are more frequently employed in acoustics as a sound prediction tool, instead of the time-consuming experiments or the expensive after-design treatments. In this study, computational aeroacoustics methods are employed to analyse the flow and the noise emission in a centrifugal fan. Unsteady flow inside the centrifugal fan is predicted with large eddy simulation. Acoustic sources are computed based on the results of the time-dependent flow simulation. The turbulent pressure fluctuations on the blades and on the volute of the fan are used as the source terms in the acoustic analogy of Ffowcs Williams and Hawkings. Propagation, diffraction and scattering of the acoustic sources inside the volute are computed with the boundary element method. Numerically obtained sound pressure level distribution in narrow band frequency spectra are compared with experimental measurements at certain microphone points. The numerical and experimental sound intensity maps are also compared to validate the numerical prediction of directivity. Computational results agree well with the experimental data. Furthermore, computational data provide an insight of the noise emission mechanisms in the centrifugal fan and can be employed to design low noise centrifugal fans.

Biography: Esra Sorguven received her BSc degree in Chemical Engineering from Boğaziçi University, in Turkey, and MSc in Chemical Engineering from FAU Erlangen, Germany. She has a PhD degree in Mechanical Engineering from University of Karlsruhe, Germany. She is currently working in the Department of Mechanical Engineering at Yeditepe University, Turkey, as an Associate Professor. Her research is focused on computational fluid dynamics, aeroacoustics and biothermodynamics.