

Insights Into the Acoustic Near and Far Field Based on Synchronized PIV and Microphone Measurements

L. Siegel^{1,*}, A. Henning^{*1}, K. Ehrenfried¹, , C. Wagner^{1,2}

1: German Aerospace Center (DLR), Institute for Aerodynamics and Flow Technology, Göttingen, Germany

2: 2: Technical University Ilmenau, Institute of Thermodynamics and Fluid Mechanics, Ilmenau, Germany

* Correspondent author: arne.henning@dlr.de

Keywords: Aeroacoustics, PIV, Causality Correlation

HIGHLIGHTS

- The work provides insights on how acoustic particle velocity is generated from an aeroacoustic source and emitted from the near- into the far-field.
- PIV measurements with a dynamic of up to 400 px are performed in order to resolve acoustic fluctuations.
- Findings agree with results from analytical and numerical solutions.

ABSTRACT

The aim of this study is to detect and visualize the propagating sound waves emanating from a flow around different types of rods. For this purpose, synchronous Particle Image Velocimetry (PIV) and microphone measurements were performed in an aeroacoustic wind tunnel. The velocity fluctuations were recorded not only in the vicinity of the rods but also in several regions between the wake flow field and the far field microphone. By means of the correlation between velocity and pressure fluctuations, coherent structures within and outside the flow could be identified. In particular, the temporal and spatial development of these structures provides an insight into the sound generation mechanism and the transition between the acoustic near and far field. **The Figure on the right shows a comparison of the instantaneous cross-correlation function for the experimental (left), analytical (center) and numerical solutions (right).**

