4D-PIV advances to visualize sound generation by airflows

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The recent developments of the Tomographic Particle Image Velocimetry technique and data reduction techniques for non-intrusive pressure field characterization method opens unforeseen perspectives in the area of unsteady flow diagnostics and experimental aero-acoustics. As a result of this work it is now possible not only to quantify complex flows in their three-dimensional structure, but also to extract quantities such as the instantaneous fluid flow pressure field.

The current research is directed towards an innovative approach to experimental aeroacoustics making use of time-resolved Tomographic-PIV experiments to fully describe and quantify the flow pattern around aircraft critical components and the related acoustic source term at its origin. The use of aeroacoustic analogies in conjunction with PIV data will provide the basis for the estimation of sound source identification and noise emissions.

The flow-visualization inspired aeroacoustics approach is introduced and its working principles are discussed with a first application of time-resolved planar PIV to the rod-airfoil problem, a benchmark for vortex-structure interaction noise. Also highlights from current activities on 3D experiments on jet-noise will be given.

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