

Experimental Investigation of the Aeroacoustics Field for a Rectangular Jet Impinging on a Slotted Plate: Stereoscopic Particle Image Velocimetry Measurement before and after the Plate

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Abstract : The acoustic of an impinging jet holds significant importance in the engineering field. In HVAC systems, the jet impingement, in some cases, generates noise that destroys acoustic comfort. This paper presents an experimental study of a rectangular air jet impinging on a slotted plate to investigate the correlation between sound emission and turbulence dynamics. The experiment was conducted with an impact ratio $L/H = 4$ and a Reynolds number $Re = 4700$. The survey shows that coherent structures within the impinging jet are responsible for self-sustaining tone production. To achieve this, a specific experimental setup consisting of two simultaneous Stereoscopic Particle Image Velocimetry (S-PIV) measurements was developed to track vortical structures both before and after the plate, in addition to acoustic measurements. The results reveal a significant correlation between acoustic waves and the passage of coherent structures. Variations in the arrangement of vortical structures between the upstream and downstream sides of the plate were observed. This analysis of flow dynamics can enhance our understanding of slot noise.

Keywords : impinging jet, coherent structures, SPIV, aeroacoustics

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