

A NUMERICAL APPROACH TO POSSIBLE IDENTIFICATION OF THE NOISIEST ZONES OF A WALL SURFACE WITH A FLOW INTERACTION

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This paper examines the use of the Proper Orthogonal Decomposition (POD) and Singular Value Decomposition (SVD) to identify zones on the surface of the blade that contribute the most to the sound power the blade radiates. First, OpenFoam Computational Fluid Dynamics (CFD) is used to obtain the pressure field at the surface of the blade moving in a subsonic regime. Then, the fluctuation of this pressure field is used as the input of the loading noise in the acoustic analogy of Ffowcs Williams and Hawkings (FW&H). The FW&H analogy is used to calculate the sound power that is radiated by the blade. Secondly, the most important acoustic modes of the POD and SVD are used to reconstruct the radiated sound power. The results obtained by POD and SVD are similar to the acoustic power directly obtained with the FW&H analogy. It is observed that the importance of the modes to the radiated sound power is not necessarily in ascending order (for the studied case, the 7th mode was the main contributor). Finally, the maps of the most contributing modes of the POD and SVD are visualized. These maps show the zones on the surface of the blade, where the dipolar aeroacoustic sources contribute the most to the radiated sound power. It is expected that these identification be used as a guidance to design and shape blade surface for reducing its radiated noise.

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