Numerical Simulation of Aeroacoustic Noise Generated from a Fan Used for Electronics

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Abstract

The noise radiated from a fan used for cooling electronic devices is becoming a big issue in the office environment. The objectives of this project are to clarify the mechanism of fan noise and to establish the fan noise prediction method. So far, the source of fan noise has been considered to originate with complicated fluid phenomena, such as vortex shedding from blade tip and trailing edge, turbulent boundary layer on blade surface and potential interaction between blade and strut. In this study, the target fan for analysis is a small low-pressure low-speed axial-flow fan with a seven-blades rotor and four struts. The effect of potential interaction between blade and strut is considered by handling the rotor part as rotational coordinate system and the strut part as stationary coordinate system. The fluid calculation is performed by Large Eddy Simulation (LES) with approximately 30 million elements in order to resolve the smallest dominant eddies. The turbulent structures around blade, such as tip vortex and leading edge vortex, are captured with a high accuracy. It is also shown that high vorticity clusters propagating between adjacent blades, which is often called “rotating stall cell”, is observed when flow rate is low.

Keywords: Large-Scale Simulation, Fan, LES, Aeroacoustics