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Large eddy simulation of tip-leakage flow in an axial flow fan[1] KEUNTAE PARK, HAECHEON CHOI, Seoul Natl Univ, SEOKHO CHOI, YONGCHEOL SA, LG Electronics, OH-KYOUNG KWON, Korea Institute of Science and Technology Information — An axial flow fan with a shroud generates a complicated tip-leakage flow by the interaction of the axial flow with the fan blades and shroud near the blade tips. In this study, large eddy simulation is performed for tip-leakage flow in a forward-swept axial flow fan inside an outdoor unit of an air-conditioner, operating at the design condition of the Reynolds number of 547,000 based on the radius of blade tip and the tip velocity. A dynamic global model (Lee *et al.*, 2010, PoF) is used for a subgrid-scale model, and an immersed boundary method in a non-inertial reference frame (Kim & Choi, 2006, JCP) is adopted. The present simulation clearly reveals the generation and evolution of tip-leakage vortex near the blade tip by the leakage flow. At the inception of the leakage vortex near the leading edge of the suction-side of the blade tip, the leakage vortex is composed of unsteady multiple vortices containing high-frequency fluctuations. As the leakage vortex develops downstream along a slant line toward the following blade, large and meandering movements of the leakage vortex are observed. Thus low-frequency broad peaks of velocity and pressure occur near the pressure surface.

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Keuntae Park
Seoul Natl Univ

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