

An optimization study on the aerodynamic design of counter rotating axial fan

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Keywords: Counter rotating fan, Coaxial contra rotating, Optimization, Blade design, Efficiency enhancement, CFD (Computational Fluid Dynamics)

Abstract: Since the torque on a fan system from a pair of counter rotating rotors effectively cancels out, the counter rotating fan could be a promising way to achieve the recent requirement of energy consumption. The present paper focuses on the optimization of the aerodynamic blade design of the counter rotating fan with CFD simulation and DOE method. The incompressible full 3-D Navier-Stokes equation is solved with the frozen rotor method to consider the rotating motions of the pair of counter rotating rotors. The operation conditions of the counter rotating rotors are -11500 rpm and 9000 rpm, and the parameters of aerodynamic blade design are stagger angle, inlet blade angle, max camber position ratio, max blade thickness ratio, number of blade. The main effect of all design parameters are obtained from the DOE method, and the mechanisms of improved aerodynamic performance are discussed. The results of the present study could provide useful data for optimal aerodynamic design of the counter rotating fan system.