# Effect of Two-Dimensional Anti-Stall Fin on the Performance of an Axial Fan at Low Flow Rates

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## Abstract

The stall in an axial fan is directly related to detrimental phenomena such as performance degradation, vibration, noise, and flow instability at low flow rates. As a kind of passive control method to handle the stall, two-dimensional plates so-named anti-stall fin (ASF) were suggested by ourselves and were attached inside the casing. In the case of an axial fan without the ASF, the backflow gradually increased in the spanwise direction toward the hub and the streamwise direction to the inlet passage (upstream), as the flow rate decreased, and the rotating stall was developed through the quickening-growing-setting period. However, an ASF-attached axial fan stably recovered performance degradation in the stalling flow rates and allowed to form a negative slope to 0.5Φ_d. This study was mainly based on numerical simulations, while the performance before/after application of the ASF was validated through experimental tests. The ASF's functional limitations for various design parameters, which the ASF can derive aerodynamically, were presented as the primary focus of this study. Each one-factor analysis was performed, and the internal flow pattern was observed in parallel at the point where the ASF lost its function. For the radial length, axial length, number of fins, and positive-tangential angle, the ASF almost retained its function up to the limitation to prevent instability but radically lost its function at a certain flow rate. For the axial gap and negative-tangential angle, the ASF gradually lost its function.