

Abstract Submitted
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Corner separation and the onset of stall in an axial compressor¹ AICHA THIAM, ROBERT WHITTLESEY, CANDACE WARK, DAVID WILLIAMS, Illinois Institute of Technology — Axial compressor performance is limited by the onset of stall between the diffusing passageways of the rotors and stators. The flow physics responsible for the stall depends on the blade geometry of the machine, and in this experiment stall develops from a blade-hub corner separation. The 1.5 stage axial compressor consists of inlet guide vanes, a rotor and stator section. Separate motors drive the downstream fan and rotor, which makes it possible to change the compressor pressure ratio and flow coefficient by changing either the wheel speed or the bulk flow rate through the machine. Detailed maps of the flow behind the stators and in front of the rotors were obtained using a Kulite stagnation pressure probe. Mean pressure measurements show the growth of the corner flow separation and divergence of the “through flow” toward the outer casing. Spectra show a sensitivity of the separated region to small amplitude external disturbances, in this case originating from the downstream fan. The onset of rotating stall appears as the first subharmonic of the rotor frequency, $0.5 f_r$, then shifts to a slightly lower frequency $0.45 f_r$ as the flow coefficient is decreased.

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