Abstract Submitted
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Plasma-based Compressor Stall Control[1] RYAN MCGOWAN, THOMAS CORKE, University of Notre Dame — The use of dielectric barrier discharge (DBD) plasma actuator casing treatment to prevent or delay stall inception in an axial fan is examined. The actuators are powered by a pulsed-DC waveform which induces a larger peak velocity than a purely AC waveform such as a sine or sawtooth wave. With this system, a high-voltage DC source is supplied to both electrodes, remaining constant in time for the exposed electrode. Meanwhile, the covered electrode is periodically grounded for several microseconds and allowed to rise back to the source DC level. To test the actuators' ability to interact with and modify the formation of stall cells, a facility has been designed and constructed around nonconductive fan blades. The actuators are installed in the fan casing near the blade tips. The instrumentation allows for the measurement of rotating pressure disturbances (traveling stall cells) in this tip gap region as well as fan performance characteristics including pressure rise and flow rate. The casing plasma actuation is found to reduce the correlation of the rotating stall cells, thereby extending the stall margin of the fan. Various azimuthal arrangements of the plasma actuator casing treatment is explored, as well as input voltage levels to the actuator to determine optimum conditions.

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