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Inter-turbine Duct Flow Separation Control with SDBD Plasma Actuators: Simulation BRIAN NEISWANDER, THOMAS CORKE, FLINT THOMAS, JOSEPH NIEWIAROWSKI, RULONG MA, University of Notre Dame — Reducing the duct length between turbine stages provides a weight savings, and can effectively increase overall performance. Significant length reductions however can lead to separated flow regions that require flow control techniques to correct. This research utilizes FLUENT CFD analysis to simulate the flow in diffusing inter-turbine ducts, and include the effect of SDBD plasma actuators to control flow separation. Two duct geometries are presented; both are annular and divergent in shape but differ in axial length. The shorter duct, featuring a more aggressive bend, exhibits a flow separation, whereas the longer one does not. For the separated duct case, the effect of plasma actuators placed azimuthally around the duct at a specified streamwise location are modeled by a body force distribution along the duct wall. To save computation time, each duct is meshed in 3D as a quarter of the full 360° duct using periodic boundary conditions on the radial edges. At the inlet, the flow Mach number is 0.5 with no swirl and a low turbulence intensity. Solutions are obtained using a coupled, unsteady, RANS solver with a standard $k - \epsilon$ viscous model and enhanced wall treatment. Computational results are compared with experimental results in a specially designed facility at the University of Notre Dame.

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