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DIFFUSIVE TURBINE GEOMETRIES

Diffusive turbine geometry operates seamlessly from subsonic to supersonic for next-gen propulsion.

Researchers at Purdue University have developed a turbine geometry that can function at any inlet Mach number, with air speeds ranging from low-subsonic to high-supersonic, including the transition from subsonic to the supersonic regime. Contrarily, conventional turbines can only operate under a narrow range of inlet conditions and are unsuitable for applications in propulsive systems in which the air speed fluctuates substantially, like in rotating detonation engines. The Purdue researchers designed the endwalls such that the throat area was larger than the inlet area. The configuration of the turbine row can be tuned for high performance depending on the inlet conditions and geometric constraints of the application. Smooth, contoured hub and shroud endwall geometries provide a controlled diffusion with a short length, suitable for compact fluid machinery. The change in the channel height may be applied upstream of the leading edge of the airfoil, and/or along the airfoil, and may not be symmetric to the channel mean radius. Depending on the application, extensions upstream and/or downstream of the airfoil can also be added to minimize flow separation.

Technology Validation: The turbine offers continuous operation from Mach 0.1- 6 without choking.

Advantages

- Flexible to fluctuating, unsteady air speeds

- Extended operability

- Amenable to different propulsive systems and components upstream and downstream

Applications

- Axial or mixed flow turbines for gas turbine engines, power generation units, or other propulsive systems

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