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Tomographic-PIV and TSP for Airfoil Flow-Control Studies
ADAM STOLT, JOHN OTTE, JESSTIN KRECH, JORDI ESTEVADEORDAL, North Dakota State University — Airfoil blades can experience a significant change of angle of attack during operation cycles that can lead to boundary layer separation and dynamic stall. It is unclear how elements distributed at the leading edge would affect the aerodynamic performance, boundary layer separation and transition, and stall behaviors. In the present study, various passive flow control structures, such as distributed dimples and bumps have been investigated and compared to airfoil geometries including the baseline smooth NACA0015 airfoil. Along with standard particle image velocimetry (PIV), a curved-laser sheet PIV, tomographic PIV, and Temperature Sensitive Paint (TSP) techniques have been combined to reveal spanwise flow information in the curved surface of the airfoil. Results show the effects and induced flow patterns of the various elements on boundary layer separation and stall at various angles of attack and compare them with the smooth models.

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