Abstract Submitted
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Frequency-Domain Proper Orthogonal Decomposition of Synthetic-Jet Actuated Flow for Airfoil Control[1] GUY BEN-DOV, ARNE J. PEARLSTEIN, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, DANIEL P. BRZOZOWSKI, ARI GLEZER, Woodruff School of Mechanical Engineering, Georgia Institute of Technology — Using a proper orthogonal decomposition in the *frequency domain*, we construct a forced ODE system for use as a reduced-order model of flow over an actuated airfoil. The time-dependent part of the flow in the wake, attributable to actuation, is linearized about the mean wake flow (generated from time-averaged flow fields obtained from PIV data). The resulting PDE system consists of the continuity and linearized vorticity transport equations. Using instantaneous inlet conditions from several realizations with different actuation, we apply a spectral method to compute the impulse response of the PDEs in the frequency domain over a wide range of frequency. The decomposition allows substitution of the resulting modes into the PDEs, and Galerkin projection to ODEs. Only the forcing terms are frequency-dependent, and they can be parametrized on an actuator-specific basis. A neural network technique is suggested to relate the dynamics (given by the ODEs) to the aerodynamic forces on the airfoil, which will allow the model to be used as the basis of a control system.

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