Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Linear Reduced-order Model based on Particle-image-velocimetry Data of Flow Field around Airfoil Controlled by Plasma Actuator[1] KOKI NANKAI, KENTO SUZUKI, ATSUSHI KOMURO, Tohoku University, TAKU NONOMURA, Tohoku University, Presto, JST, KEISUKE ASAI, Tohoku University — A linear reduced-order model of flow fields around an airfoil controlled by a dielectric-barrier-discharge plasma actuator (DBDPA) is constructed based on particle image velocimetry (PIV) data. Velocity field data around a NACA0015 airfoil with random input by the DBDPA at the chord Reynolds number of 64,000 were acquired using PIV in a wind tunnel test. Subsequently, lower-dimensional description of the data was obtained by proper orthogonal decomposition (POD). The coefficient matrix of the linear model was computed using the least-squares approximation with the POD-mode coefficients and control input data, similar to dynamic mode decomposition with control. The effects of the control input corresponding to the voltage amplitude of DBDPA on the low-dimensional velocity fields reconstructed by the first ten POD modes were investigated from the input matrix. It is demonstrated that the velocity fields are more sensitive to the input change than the average value of the input. This result implies that the present model can show the well-known flow control characteristic that DBDPA with intermittent actuation such as the burst mode or nanosecond-pulse-driven mode is more effective for the separation control of flow fields than continuous actuation.

[1]This research is partially supported by Presto, JST (JPMJPR1678).

Koki Nankai
Tohoku University

Date submitted: 01 Aug 2019 Electronic form version 1.4