Abstract Submitted
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Long Lasting Modifications to Karman Vortex by a Single Pulse of DBD Plamsa[1] KWING-SO CHOI, TIM JUKES, University of Nottingham — We discovered a unique phenomenon whereby the vortex shedding and force fluctuations on a circular cylinder in cross flow are halted for a considerably long duration by applying a single, short-duration pulse of DBD plasma close to flow separation points. This period of flow modifications is equivalent to over 150 times that of the plasma excitation. We believe this is due to the induced vortex by a short-duration plasma pulse that interacts with the Karman vortex formation. As a result, the drag and lift fluctuations are reduced by 8% and 40%, respectively. This corresponds to the power-saving ratio of nearly 1200, or the energy efficiency of more than 50%. Experiments were conducted in a wind tunnel, where the free-stream velocity was 4.6 m/s and the turbulence intensity was 0.5%. The Reynolds number based on the diameter of circular cylinder was 15000. A single asymmetric DBD plasma actuator was placed on a circular cylinder at 75°, where a pulse of DBD plasma with a short duration (5% of the vortex shedding period) was applied at a high ac voltage (7.4 kV peak-to-peak, 33 kHz). Simultaneously with the force measurements using a two-component dynamic force balance, the global flow field in the near wake of a circular cylinder was studied using a time-resolved PIV system.

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