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Forcing the shear layer of a backward-facing step flow using DBD plasma actuator JEAN-LUC AIDER, THOMAS DURIEZ, JOSE EDUARDO WESFREID, PMMH (UMR 7636 CNRS - ESPCI - Univ. Pierre et Marie Curie - Univ. Paris Diderot), GUILLERMO ARTANA, Laboratorio de FluidoDinamica, Univesitad de Buenos Aires — The Kelvin-Helmholtz convective instability is the key mechanism in a backward facing step (BFS) flow. The natural flow selects the most amplified mode below the cutoff wavenumber. We introduce time-dependant perturbations inside the shear layer using a DBD plasma actuator. The perturbation is a pulsed low velocity spanwise jet, parallel to the mean flow. It is introduced inside the boundary layer, just upstream separation. Using time-resolved visualizations we show that forcing with a given frequency can have a dramatic effect on the spectral content of the flow and its global properties. The modification of the BFS flow depends strongly on the value of the frequency with respect to the natural frequency. Using 4Hz Particle Image Velocimetry (PIV) we study the evolution of time-averaged properties such as the recirculation length or the shear layer thickness. Recording the forcing perturbation signal together with the PIV acquisition signal we achieve phase-average reconstruction based on the forcing frequency. The phase-averaged time series give access to the wavelength, phase velocity and the spatial distribution of the vortex shedding. It also allows us to build the stability diagram of the shear layer.

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