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Suppression of wake's instabilities by optimal streaks GERARDO DEL GUERCIO, IMFT Toulouse - PSA Peugeot Citroen, CARLO COSSU, CNRS - IMFT Toulouse, GREGORY PUJALS, PSA Peugeot Citroen — Wakes can sustain large transient energy growth. Optimal perturbations are computed for the cases of parallel, weakly non-parallel and the circular cylinder wakes. Streaks are found to be the optimal amplified structures produced by the non normal energy amplification. The level of energy increases with the spanwise wavelength of the perturbations except in the circular cylinder wake where the optimal is reached for $\lambda_z \approx 6\,D$. In parallel wakes these streaks are shown to suppress the absolute instability. Furthermore the global instability of the weakly non-parallel and the circular cylinder wakes can be completely annihilate with moderate streaks amplitudes. The comparison of these spanwise periodic (3D) optimal perturbations with the spanwise uniform (2D) control showed that the energy required to stabilize the wake is always smaller for the 3D control. Moreover the sensitivity of the global mode growth rate is discovered to be quadratic for 3D perturbations while being linear for 2D ones meaning that usual first order sensitivity analysis is unable to predict their larger efficiency.

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