Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Stability of the laminar wake behind spinning axisymmetric bluff bodies: sensitivity and control[1] JOSE IGNACIO JIMENEZ-GONZALEZ, CARLOS MARTINEZ-BAZAN, Universidad de Jaen, WILFRIED COENEN, CARLOS MANGLANO, ALEJANDRO SEVILLA, Universidad Carlos III de Madrid — We carry out direct and adjoint global stability analyses of the laminar wake behind several spinning axisymmetric bluff bodies, i.e. sphere, hemisphere, bullet-shaped bodies of ellipsoidal nose and spherical nose respectively; for moderate Reynolds numbers (Re$\leq$450) and values of the spin parameter ($\Omega \leq 1$), defined as the ratio between the azimuthal velocity at the outer body surface and the free-stream velocity. Both the axisymmetric base flow computations and the assembling of the eigenvalue problems are tackled by means of the finite element solver FreeFEM++, computing finally the eigenmodes with an Arnoldi algorithm in Matlab. We show that spin acts as a stabilization mechanism for the wake behind bodies with a cylindrical trailing part, while it destabilizes the wake of the other geometries. The computation of the adjoint modes and the identification of the wavemaker allow us to discuss the nature of the different unstable modes found and understand the differences in the stabilizing or destabilizing effect of rotation due to the base flow modifications. The controllability of the unstable regimes by means of base bleed is also addressed.

[1]Supported by the Spanish MINECO, Junta de Andalucía and EU Funds under projects DPI2011-28356-C03-03 and P11-TEP7495.

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Date submitted: 01 Aug 2014 Electronic form version 1.4