Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Phase locking and unlocking of the symmetry-breaking mode of 3D bluff bodies turbulent wakes[1] GUILLAUME BONNAVION, OLIVIER CADOT, IMSIA - ENSTA ParisTech, DENIS SIPP, ONERA Meudon, VINCENT HERBERT, Groupe PSA, SYLVAIN PARPAIS, Renault, RÉMI VIGNERON, GIE-S2A, JEAN DÉLERY, ONERA Meudon — The influence of small steady geometrical constraints such as a yaw or a pitch angle applied to the squareback Ahmed body ($Re = 400000$) or wall proximity is investigated experimentally using unsteady base pressure, PIV and force measurements. The global turbulent wake properties are characterized with a polar description of the instantaneous base pressure gradient. Whatever the constraint, a coherent structure, called static symmetry-breaking mode (SB mode), is found with an almost constant modulus but with very different phase dynamics. The imposed geometrical constraints are associated with a deterministic component of the base pressure gradient and the phase dynamics adapts, when possible, to satisfy both the constant modulus and the deterministic component of the base pressure gradient. The phase dynamics result either in wake bi-stability, in phase locking or in a global unlocking with random explorations. A stochastic model adapted from that of the axisymmetric bluff body is applied to the base pressure gradient. The aerodynamic loading on the body is decoupled from the wake modes by means of a base cavity known to stabilize the SB mode. Both approaches are expected to provide the necessary ingredients to model the fluid force exerted on 3D bluff bodies with a blunt base.

[1]Work funded by the CNRT R2A

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Date submitted: 26 Jul 2017 Electronic form version 1.4