Abstract Submitted
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A computational study of golfball aerodynamics: effects of rotation[1] NIKOLAOS BERATLIS, KYLE SQUIRES, Arizona State University, ELIAS BALARAS, University of Maryland — An efficient finite-difference Navier-Stokes solver is used to carry out a series of simulations of a spinning golfball at three distinct flow regimes: subcritical, critical and super-critical. The golfball is treated using an embedded boundary formulation, where the velocity near the surface is locally reconstructed to satisfy the proper boundary conditions. All scales down to the dimples are resolved by means of direct numerical simulations. Results exhibit all the qualitative flow features that are unique in each regime, namely the drag crisis and the alternation of the Magnus effect. In particular, the key features in each regime are captured and the correct trends are reproduced in all cases, namely a significant drop in the drag coefficient from the sub-critical to the critical regime and a subsequent drop as the Reynolds number gets into the super- critical regime. In addition, the lift exhibits a change in sign from positive to negative values when the Reynolds number increases from sub-critical to critical values. These phenomena are explained in terms of the distinct boundary layer dynamics present in each regime and are further illuminated by flow visualizations.

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Elias Balaras
University of Maryland

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