Abstract Submitted
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LES of a submarine model in self-propulsion[1] ANTONIO POSA, ELIAS BALARAS, The George Washington University — Wall-resolved LES computations are presented on the flow over a notional submarine geometry in self-propelled conditions at Re=1.2e+06 (based on the free-stream velocity and the length of the body). The rotational speed of the propeller was dynamically adjusted during the simulation using a proportional-integral controller, in order for the propeller thrust to balance the overall drag on the system. An immersed-boundary methodology was adopted to enforce boundary conditions over the body. Comparisons with the same submarine geometry in the towed configuration allowed us to verify that the boundary layer over the hull surface is affected only in the stern region, while that over the cylindrical mid-body is roughly in equilibrium in both towed and self-propelled conditions. The quasi-streamwise structures of the turbulent boundary layer and their development along the stern dominate the flow ingested by the propeller. The wake and junction flows from the fins break the axial symmetry of such flow. Comparisons with the towed configuration verify that the propeller affects substantially its own inflow, defined by the overlapping effects of adverse pressure gradient, due to the tapered geometry of the stern, and suction generated by the same propeller.

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