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A numerical study of vortex-induced drag of elastic swimmer models THOMAS ENGELS, M2P2-CNRS, Aix-Marseille University, Marseille, France & Institut für Strömungmechanik und Technische Akustik (ISTA), TU Berlin, Germany, DMITRY KOLOMENSKIY, Department of Mathematics and Statistics, McGill University, Montreal, Canada, KAI SCHNEIDER, M2P2-CNRS & CMI Aix-Marseille University, Marseille, France, JOERN SESTERHENN, Institut für Strömungmechanik und Technische Akustik (ISTA), TU Berlin, Germany — Swimming organisms exploit bending waves to produce propulsive force. The achievable cruising speed, depends on the drag force, which balances the propulsive force. Predicting the cruising velocity at intermediate Reynolds numbers thus requires accurately predicting the drag force. In addition to the friction drag, the vortex induced drag, which may play a significant role, has only recently gained the attention of experimentalists. Based on observations obtained using simplyfied mechanical swimmers, which consist of flexible plates with driven pitching motion, Raspa et al. (PoF 26, 2014), established a basic model to explain the influence of the finite aspect ratio by the formation of trailing longitudinal tip-vortices. Here, these generic swimmers are simulated numerically. We vary the aspect ratio in order to assess the influence of coherent vortices on the drag force. The solid model is based on chordwise flexible foils that undergo large, non-linear deformations. They are actively coupled with a 3D Navier-Stokes solver, based on Fourier transforms and the volume penalization to impose the no-slip boundary conditions. The numerical approach allows to access the entire 3D instantaneous flow field and yields thus new insights into the vortex-induced drag.

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