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On the inertial motions of liquid-filled rigid bodies GIUSY MAZZONE, GIOVANNI GALDI, PAOLO ZUNINO, University of Pittsburgh — We consider a rigid body with a cavity completely filled by a viscous liquid and study the inertial motions of the system liquid-filled rigid body $\mathcal{S}$. The equations governing the motion of this coupled system are given by the Navier-Stokes equations and the equations of the balance of the total angular momentum of $\mathcal{S}$ in absence of external forces and torques. Given any initial motion to the coupled system, characterized by an initial relative velocity of the fluid and an initial total angular momentum, we give a complete description of the behavior that the system liquid-filled rigid body will show at large times. From both analytical and numerical viewpoints, we are able to prove a longstanding conjecture stated by Zhukovskii, namely that $\mathcal{S}$ will eventually reach a steady state which is a rigid body permanent rotation. In other words, the liquid goes to rest with respect to the rigid body and the coupled system will rotate as a whole rigid body, with a constant angular velocity that is directed along one of the principal axes of inertia of the system.

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