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Hydrodynamical force on a solid sphere in an incompressible inviscid fluid[1] RABAB ALARKI, Department of Mathematics Statistics, Texas AM University, Corpus Christi, D. PALANIAPPAN, Texas AM University, Corpus Christi — Simple analytic results for the hydrodynamical force exerted on a rigid sphere of radius a placed in singularity driven potential flows are determined. The motion induced singularities considered are (i) a source; (ii) a dipole; and (iii) a vortex ring, located at $(0, 0, c)$, where $c > a$. The calculation is based on the exact solutions of the classical Neummann boundary value problem for a spherical boundary in inviscid hydrodynamics. The expressions for the force due to source and dipole are found to be algebraic in a/c, the radius-location ratio, while the result for a vortex ring is expressed in an integral form. Our analysis shows that the force due to a tangentially oriented initial dipole is less than that of a dipole in the radial direction. Graphical illustration are presented demonstrating the variation of the force with respect to a/c. The results may also be of intersect in the study of superfluids - treated as incompressible fluids - such as liquid helium or the interior of a neutron star.

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