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Effect of the local geometry on the motion of a filamentary vortex OSCAR VELASCO FUENTES, Departamento de Oceanografia Fisica, CICESE, Mexico — In his seminal paper on vortex motion Helmholtz (1858) showed that a curved vortex moves within the fluid whereas a straight one remains stationary. Schwedoff (1887) later claimed that the velocity of a vortex increases with the curvature and is perpendicular to the plane of curvature. This conjecture, mathematically formalized by Da Rios (1906), is now known as the local induction approximation (LIA). Here we use a higher-order Frenet-Serret representation of the vortex centerline in order to study the effect of curvature, torsion and their derivatives on the motion of a filamentary vortex. We found that, to leading order, the curvature induces a vortex velocity in the binormal direction, the torsion induces velocity in the tangential direction and the changes in curvature and torsion along the vortex induce velocity in the normal direction. We verify these results by studying, separately, the evolution of a helical vortex and an elliptical vortex ring, whose motion is also calculated using different analytic/numerical methods.

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