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Helicity and its Geometric Evolution in Viscous Vortex Loops[1]
ROBERT MORTON, James Franck Institute, University of Chicago, XINRAN ZHAO, Department of Mechanical Engineering, Purdue University, HRIDESH KEDIA, Physics, Massachusetts Institute of Technology, DANIEL PERALTA-SALAS, ICMAT Madrid, CARLO SCALO, Department of Mechanical Engineering, Purdue University, WILLIAM IRVINE, James Franck Institute, Enrico Fermi Institute, University of Chicago — The helicity of a laminar vortex ring is prescribed by its geometry in the forms of writhe and twist. In viscous fluids, helicity is not conserved, but nonetheless its evolution is naturally characterized by the geometry and topology of the vorticity field. By generating helical vortices using hydrofoils, we are able to measure their helicity and its evolution over a range of Reynolds numbers. Fully resolved DNS simulations with adaptive mesh refinement provide complementary insight. We present an analytic model for helicity evolution in vortex tubes with a natural geometric interpretation and compare its predictions to experiments and simulations.

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Robert Morton
James Franck Institute, University of Chicago

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