The 2D Euler-Coriolis fluid: Theory and Illustration.

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Abstract

We start from a canonical Hamiltonian, Clebsch like, formulation of inviscid, compressible and rotational, charged or neutral fluids and establish their equations of motion including Euler equations for the velocity fields satisfying Helmholtz decomposition. We consider next the simplest example of a 2D perfect fluid in a rotating frame of reference, called the Euler-Coriolis fluid. Then, we take up the problem of describing the dynamics of a single cylindrical vortex immersed in an infinite compressible medium by means of the method of characteristics. A variational principle is evoked to qualify the nature of the solutions, regular and/or singular. Results of numerical analysis showing the spiraling motions of a test particle and the coupling between dilatation and vorticity in the fluid density are lastly presented.