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Vortex Induced Flows Involving Fused Cylinder/Sphere Pairs D. PALANIAPPAN, Texas A&M University Corpus Christi — The two-dimensional inviscid flow field around an infinitely long circular cylinder induced by a point vortex can be constructed via the famous Milne-Thomson's circle theorem. However, for non-circular configurations such calculations become cumbersome and even the computation of approximate solutions of the Euler equations governing the fluid flow require quite a lot of guess work. Here we show a systematic procedure to derive analytic results for a geometry consisting of two overlapping cylinder/sphere pairs in the limit of inviscid flow. Our simple approach yields the image system, also known as Neumann's Green function, describing the complete flow field induced by a vortex in the presence of a twin-circle configuration. The exact results for the uniform flow-vortex-twin circle combination are obtained via our successive-image theory and are expressed in the form of Hamiltonian/streamfunction for the system. The flow topologies for this system reveal the existence of stagnation points and streamline crossing, a strong indication of chaos. The corresponding analytic solutions for two fused spheres submerged in a flow induced by a three-dimensional vortex are also obtained. The exact solution for the twin-sphere problem is expressed in terms of standard convergent elliptic integrals which can be evaluated numerically. The results of this investigation, in general, illustrate the topography effects and are of fundamental importance in oceanography and other related topics as well.

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