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ADVANCES IN MOVING BOUNDARY PROBLEMS IN FLUID DYNAMICS

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ABSTRACT

A large number of problems in fluid dynamics include aspects of moving interfaces, embedded in complex physics, which can be described by a system of coupled PDE's. In such systems two challenging mathematical issues can be present: the existence of singular solutions in finite time and/or the topological changes that the free boundary may undergo as it evolves. New developments in these areas will be addressed, in particular PDE-based methods for tracking interfaces, including Level Sets methods and Fast Marching Methods. Recently, these PDE-based techniques have been greatly extended, both in terms of core fundamental algorithms, and in terms of attacking problems from new areas with these techniques. Various numerical techniques used for the numerical approximation of the system will include advances in a variety of methods: The finite difference method, the boundary element method, volume of fluid methods, and the finite element method, in 2 and 3 dimensions. Special attention must be paid to the formation of singularities, whether in the form of topological changes and corners or cusps at the interface. These require special numerical resolution including adaptiveness and local use of self-similar variables.

New interesting areas where these numerical methods are being implemented include jetting devices in industrial printing, drop size control in electro-spray devices, break-up of viscous and non viscous fluids, solid-fluid coupling, biological mechanics and geophysical flows to mention a few.

This minisymposium gathers together a series of talks on both new methods and new applications areas.

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