Fluidica CFD software for fluids instruction

TIM COLONIUS, Mechanical Engineering, California Institute of Technology

Fluidica is an open-source freely available *Matlab* graphical user interface (GUI) to to an immersed-boundary Navier- Stokes solver. The algorithm is programmed in Fortran and compiled into Matlab as mex-function. The user can create external flows about arbitrarily complex bodies and collections of free vortices. The code runs fast enough for complex 2D flows to be computed and visualized in real-time on the screen. This facilitates its use in homework and in the classroom for demonstrations of various potential-flow and viscous flow phenomena. The GUI has been written with the goal of allowing the student to learn how to use the software as she goes along. The user can select which quantities are viewed on the screen, including contours of various scalars, velocity vectors, streamlines, particle trajectories, streaklines, and finite-time Lyapunov exponents. In this talk, we demonstrate the software in the context of worked classroom examples demonstrating lift and drag, starting vortices, separation, and vortex dynamics.