

Outflow conditions for incompressible and Boussinesq flow

Malte Braack, Christian-Albrechts-Universität zu Kiel and D. Rueda Castillo, U. La Molina, Lima*

We propose boundary conditions for incompressible flows to model free outflow. In comparison with the standard do-nothing condition, we add certain nonlinear terms to the boundary conditions. We present the method for the Navier-Stokes and the Boussinesq system. In the latter case of non-constant temperature, the boundary condition for the temperature should be modified as well. For stability reasons, we consider weak implementations of all Dirichlet boundary conditions. The resulting system is stable and allows for proving existence of weak solutions in 2D and 3D. In order to obtain a stable discrete system we use equal-order finite elements with local projection stabilization. We give an error estimate for the discrete solution. By numerical simulations of the proposed system and comparisons with standard outflow conditions we show that the new system is more robust.