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A volume penalization method for incompressible flows and scalar advection-diffusion with moving obstacles KAI SCHNEIDER, BENJAMIN KADOCH, DMITRY KOLOMENSKIY, M2P2-CNRS & CMI Aix-Marseille University, France, PHILIPPE ANGOT, LATP-CNRS & CMI Aix-Marseille University, France — A volume penalization method for imposing homogeneous Neumann boundary conditions in advection-diffffusion equations is presented. Thus complex geometries which even may vary in time can be treated efficiently using discretizations on a Cartesian grid. A mathematical analysis of the method is conducted first for the one-dimensional heat equation which yields estimates of the penalization error. The results are then confirmed numerically in one and two space dimensions. Simulations of two-dimensional incompressible flows with passive scalars using a classical Fourier pseudo-spectral method validate the approach for moving obstacles. The potential of the method for real world applications is illustrated by simulating a simplified dynamical mixer where for the fluid flow and the scalar transport no-slip and no-flux boundary conditions are imposed, respectively.

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