

Bachelor- / Masterthesis

Analysis of Numerical Methods for Boundary Treatment in Wall-Bounded Turbulent Flow Simulations

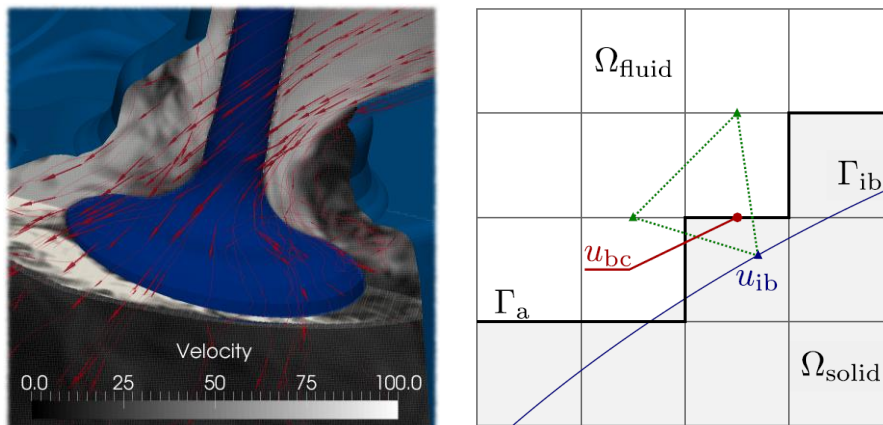


Fig. 1: High-Reynolds-Number Flow in an Engine (left) and Interpolation Stencil Used to Determine Velocity Boundary Conditions (right)

Keywords : Large-Eddy Simulations, Immersed Boundary Method, Wall Modeling, [CIAO](#)

Accurate simulations of turbulent flows require sophisticated numerical schemes and high-quality computational grids. At ITV, multi-physics Large-Eddy Simulations are carried out with the in-house code [CIAO](#), employing Cartesian Structured Meshes. With this approach, wall geometries of complex shape cannot be represented by the grid cells, but must be handled by specific types of boundary conditions, so-called Immersed Boundary Methods. The thesis can be combined with a student job.

Your Tasks:

- Literature review on Immersed Boundary Methods
- Identification of suitable simulation test cases from the literature
- Rigorous analysis of existing methods with respect to accuracy and conservation properties, using small-scale (laminar) simulations
- Application of the most-suitable method to Large-Eddy Simulations of internal combustion engine flows

Requirements:

- Good theoretical knowledge in (computational) fluid dynamics, numerical mathematics
- Interest in complex flow simulations using in-house software
- Some programming experience in any language desirable

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