# Facing Challenges in Computational Fluid Dynamics with Lattice Boltzmann Methods and OpenLB

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Abstract

An overall strategy for numerical simulations and optimization of fluid flows for industrial applications is introduced. The integrative approach takes advantage of numerical simulation strategies and newly developed mathematical optimization techniques, which are all based on kinetic model descriptions and on Lattice Boltzmann Methods (LBM) as discretization strategies [1]. Thereby, the resulting algorithms were implemented in a highly generic way in the open-source framework OpenLB [2].

In the talk, particular focus is placed on the design and application of the approach in order to face contemporary challenges in Computational Fluid Dynamics (CFD) [3, 4]. Further, the consideration of LBM as a generic technique for the approximation of Partial Differential Equations (PDE) [5] and its implementation for heterogeneous high-performance computing (HPC) platforms are highlighted. The presented approaches and realizations are illustrated by means of various fluid flow simulation and optimization examples in many different engineering fields, where specific aspects are discussed for the simulation of particulate [6] and turbulent flows [7] as well as optimal control and optimization problems.
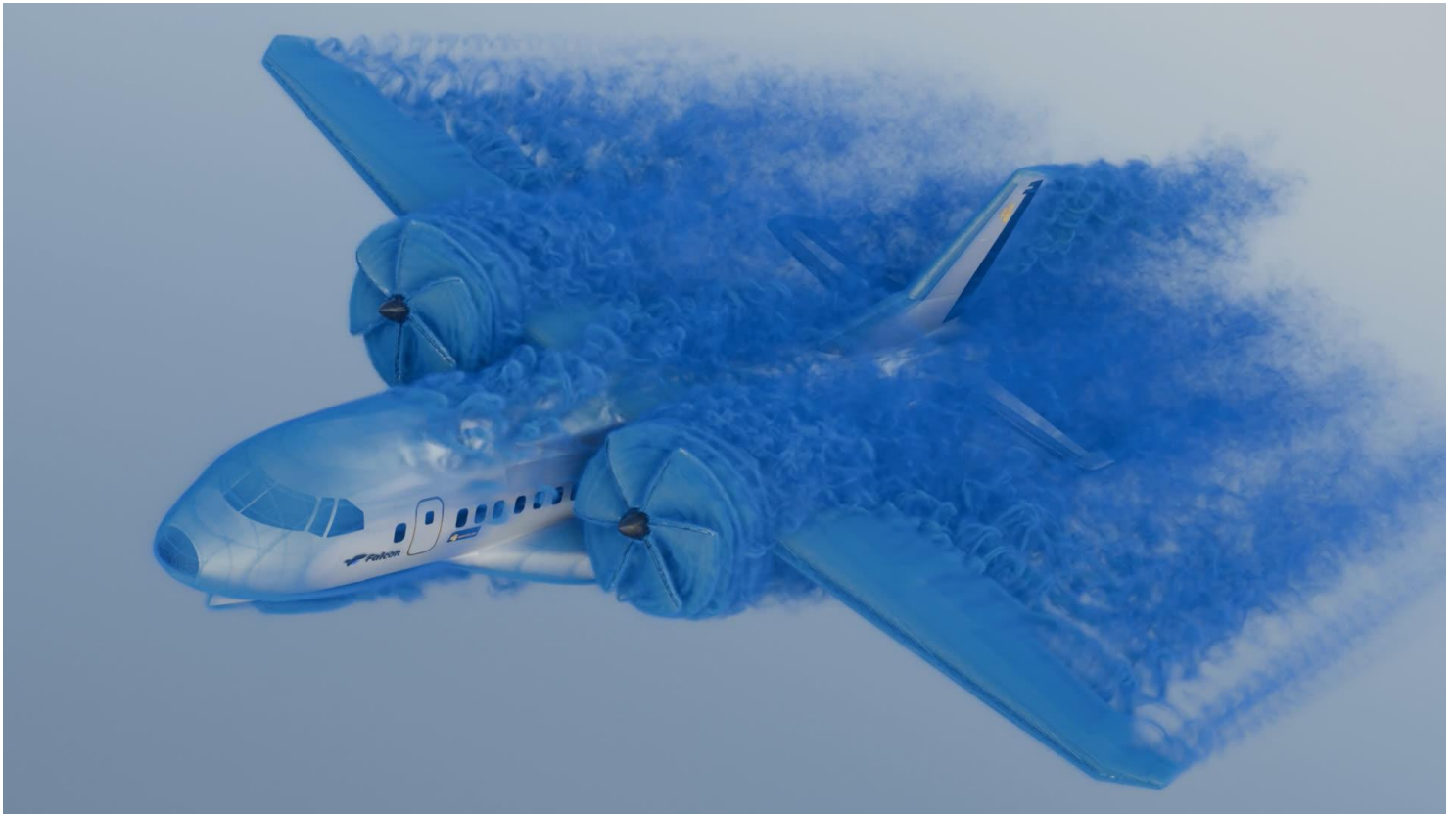
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