The Lattice Boltzmann method for automotive applications.

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In the last years numerical simulations of aerodynamic phenomena and computational fluid dynamics problems, have increased their interest , specially in automotive ones.
In fact, the wide variety of automotive design applications are strictly tied with turbulent processes, small viscosity, high velocity and particular complex shapes. Moreover, the competitive situation in the automobile industries, require a continuous increase in development speed and design reliability. This is why simulation techniques are gaining an important role in the product development.
The numerical resolution of this kind of problems meets a lot of difficulties view to the complexity of the phenomena and of the geometry under consideration and the small and large scale interactions in presence of high Reynolds number.

We approach these problems using the Lattice Boltzmann model. In this way we obtain satisfying results, with relatively short computational times, compared with other simulation models.

We assume to insert the profile of an obstacle, whose shape is extrapolated directly from a 2D CAD geometry, in a rectangular domain and simulate the behaviour of the system with high Reynolds number.
At the beginning of the simulation, we assume to have a constant horizontal velocity field on the fluid, that fills up all the domain, in which we introduce the above obstacle. After that all real parameters have been set, we compute the related mesoscopic quantities and construct the computational domain, that coincides with the real one, simply using a cubic and homogeneous lattice grid. We impose to the fluid a constant velocity in the inlet boundary during all the simulation time.

Special attention has been devoted to outlet boundary conditions and to the computation of pressure field, which is relevant for present applications.