Application of Lattice Boltzmann Method in automotive industry with focus on aeroacoustic simulations

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The lattice Boltzmann Method, associated to a turbulence model, can be used for high Reynolds number flow simulations on complex geometry. In automotive industry, the LBM-based commercial code PowerFLOW is widely used in many application fields : aerodynamic optimization, computation of aeroacoustic sources, thermal management simulations. In this talk, some examples of industrial simulations are given.

A particular focus is done on aeroacoustic applications. The LBM allows the simulation of weakly compressible flows. A theoretical analysis of the accuracy of the standard LBM-BGK and LBM-MRT schemes is provided using linear von Neumann approach. LBM is compared to the Navier-Stokes high-order schemes that are usually used in Computational AeroAcoustics (CAA).

The example of the direct computation of the noise generated by an automotive ventilation outlet is presented. Other applications such as sunroof buffeting simulation or the prediction of wall pressure fluctuations on side windows will be also discussed.