Master thesis

Aeroacoustic simulation of moving rigid bodies via lattice Boltzmann method

Air traffic, which is a major cause of environmental noise, is expected to steadily increase in the near future. Urban air mobility (UAM) is expected to cause additional annoyance in urban regions if not regulated properly. Therefore, investigation of noise generation mechanism and noise reduction technologies is of growing interest in research and industry. Distributed propulsion technologies, which are popular in current UAM concepts, involve challenging flow scenario like rotor-wing interactions, see fig. 1.

The lattice Boltzmann method features good parallelization properties as well as low dissipation and dispersion errors making it suitable for computing the turbulent flow as well as the acoustic far field at once.
In the case of a rotor-wing configuration there is no frame of reference in which neither the wing nor the rotor do not move relatively. Hence, additional challenges arise from treating the boundary condition of the solid surface traveling across the computational grid, e.g., refilling emerging cells without introducing spurious noise in performance wise efficient manner.

This thesis builds up on foregoing work evaluating different refilling schemes for academic two-dimensional flow cases. The most promising one will be chosen and extended to three dimension. Here, performance optimization from algorithmic as well as from implementation point view are essential to apply the methodology to validation cases from the literature.

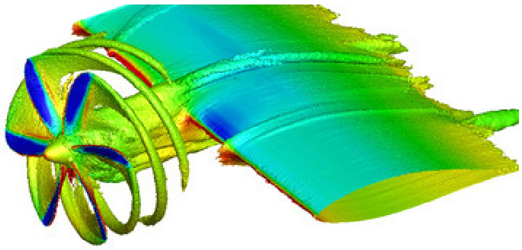

Fig. 1: Example of a rotor-wing interaction. [1] .

Research aspects

- Learn the fundamentals of LBM
- Build-up on preliminary work
- Develop knowledge on CAA methods
- Work on academic validation cases

You ...

- ... are searching for an interesting thesis in the field of aeroacoustics
- ... have advanced programming experience (preferably C++ or python)
- ... are eager to learn new skills and are able to work in an independent manner

If you are interested, please contact incl. CV and transcript of records:

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[1] P. Aref et al., Aerospace. 2018; 5(3):79. https://doi.org/10.3390/aerospace5030079