Popular scientific summary

Disputation: Andreas Nygård Osnes

Doctoral candidate Andreas Nygård Osnes at the Department of Technology Systems, Faculty of Mathematics and Natural Sciences, is defending the thesis **Shock-induced flow through particle clouds** for the degree of Philosophiae Doctor.

Kreeringssammendrag

Andreas Nygård Osnes har studert strømninger med høy hastighet gjennom tette partikkelfordelinger, og utviklet modeller for å simulere slike strømninger.

Shock-induced flow through particle clouds

High-speed flows through dense particle clouds occur in many technological applications such as explosion mitigation systems, combustion engines, drug-delivery systems, as well as natural phenomena such as volcanic eruptions and meteoroid breakup. This thesis studies such flows by means of numerical simulations.

Typical flows of interest feature trillions of particles, and it is therefore necessary to use simplified models to describe the behaviour of the particles and the flow around them. In this thesis, we use very large, accurate, simulations to study the details of shock-induced flows with a moderate number of particles. In addition, full-scale simulations with a large number of particles are used to determine the sensitivity of such simulations to modelling choices.

The simulations with few particles show that high particle concentration necessitates modifications to the drag-laws and flow model approximations that are used to simulate full-scale problems. Small-scale flow fluctuations affect the average flow statistics, and must be modelled in simulations where they are not directly captured.

The full-scale simulations show that the shock-accelerated particles self-organise and form particle jets, in agreement with experiments. To capture this process, the simulations must account for the interchange of momentum and energy between the particles and the surrounding air.
