**Computational Mechanics Group**
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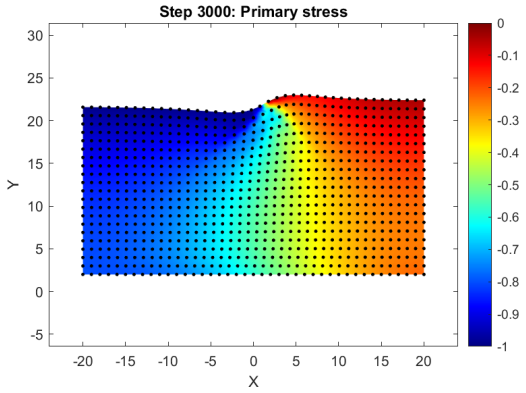
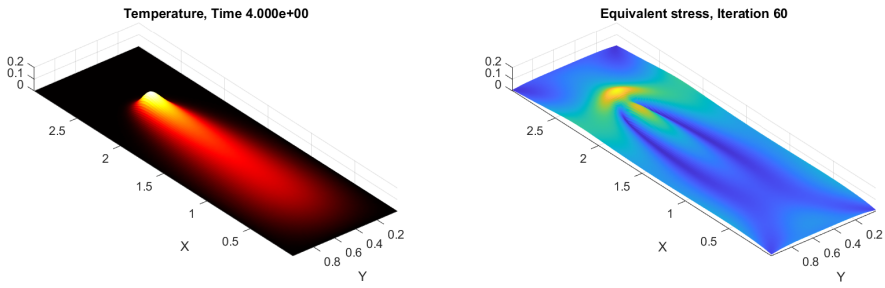
# Topic proposal

## Lattice Boltzmann method for solid mechanics

The lattice Boltzmann method (LBM) is a relatively recent numerical method for fluid mechanics, which has its theoretical foundation in gas kinetics. In a nutshell, LBM computes the evolution of a simplified model of a gas that is still complex enough to describe macroscopic fluid flow behavior. Due to its gas kinetic origin, the method comes with some beneficial properties such as algorithmic simplicity and good scaling during parallelization, which explains its continued success story in both academia and industry.
Following an alternative viewpoint, LBM can be considered more generally as a numerical scheme that solves problems outside the realm of fluid mechanics as well. This idea is the starting point of our work, where we modify the structure of LBM in a way to solve problems in solid mechanics, while fully preserving the advantageous algorithmic properties of the method. So far, we managed to solve simple examples involving linear elasticity and straight boundaries. However, in the future we plan to extend this initial idea towards more complex material behavior, more complicated problem geometries and coupling with different physics. Because these are too many ideas for us to tackle on our own, we are planning to give out some of these packages as student projects. If you read the text all the way down to here, you are probably interested in theoretical work and the design of numerical methods. Please feel free to contact us and we will discuss interesting and challenging projects in this field for your Semester project or Master's thesis.




2D plate compressed by a vertical force acting on the left half of the top side




Thermo-mechanical simulation of a single track scan of a laser powder-bed fusion process

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