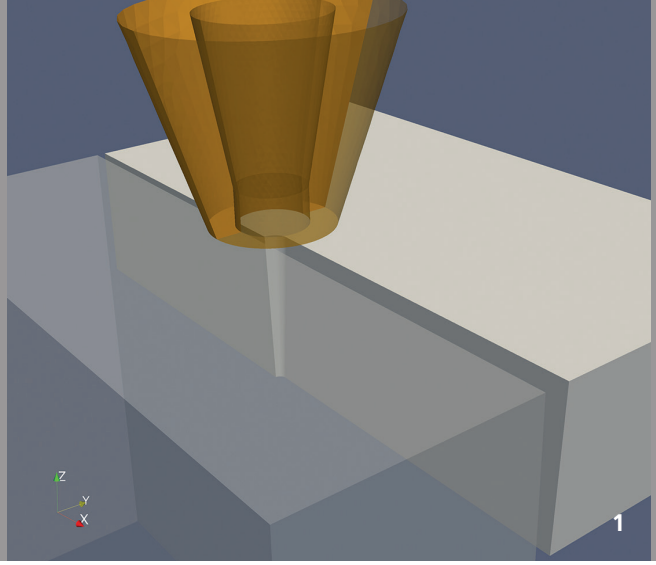

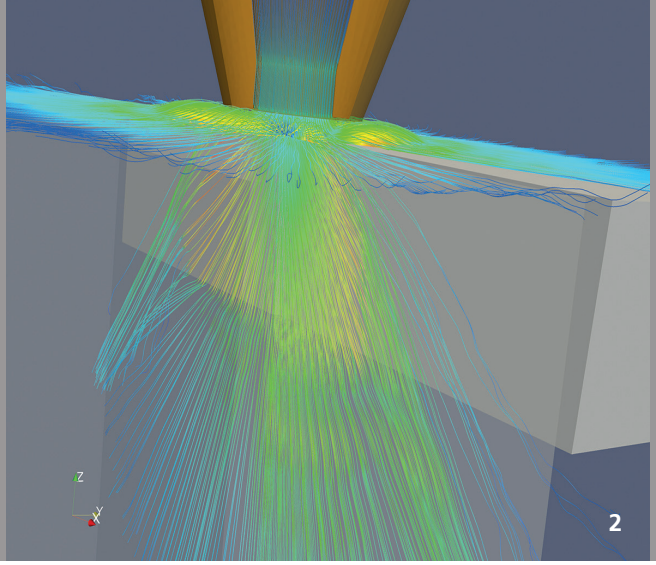

SIMULATION OF GAS FLOWS FOR IN-SITU DIAGNOSIS OF TRIMMING CUTS

Task

During in-situ diagnostics of laser fusion cutting, when trimming cuts are made, the process' melting and solidification dynamics can be observed by means of quartz glass. When this diagnostic process is used, however, kerf geometry changes, thus leading to deviations in the driving forces upon the melt caused by the cutting gas flow, in comparison to the real cut. The simulation allows the gas flow to be adjusted to the conditions of a real cut.

Method

An existing gas flow simulation code is extended so that the driving forces at the cutting front can be analyzed directly. Thereby, a discontinuous Galerkin method is used to calculate the dynamics of turbulent flow. So that the driving properties forces can be analyzed, the flow properties are averaged over a time scale typical for the present turbulent flow. To calculate the gas flow for various trimming geometries, a module is supplemented with a commercial mesh generation tool to load computational grids.

Result

The software »COMSOL« used for meshing provides a CAD import filter and enables parametric geometries to be created rapidly and efficiently. By calculating time-averaged, i.e. effective shearing forces, the software can assess computation results automatically. This simplifies the simulative adaption of gas flows and automates much of the work flow.

Applications

The newly developed work flow for the design of gas flows enables the gas flow solver to be used so effectively that gas flows for laser applications such as cutting, welding or drilling can be dimensioned with a greater deal of simplicity.

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1 Geometry for trim cut diagnosis.

2 Flow lines of the gas flow simulation.

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