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SIMULATION OF A LIQUID JET FOR BEAM GUIDING

Task

While gas-jets are commonly used in ultra-short pulsed laser ablation (e.g. in the pulse duration regime of nanoseconds), meanwhile liquid-jets are also used to guide the beam as well as to cool the workpiece. This application of liquid jets requires extensive knowledge of flow properties, as fluid jets in particular tend toward hydrodynamic instabilities.

Method

The modelling and simulation presented here aim to describe, both spatially and temporally, the free surface of the water jet as well as its speed. Therefore, the hydrodynamics are calculated, in the frame of reduced models (slender-jet equations) as well as completely numerically by means of volume-of-fluid methods, all to specify how applicable such reduced model equations are.

Result

Models of both approximation levels were implemented numerically and are available for comparison with experimental data.

Applications

The simulation can be adapted to the modelling of other fluid jets and, thus, applied to simulations of other laser manufacturing processes for which the flow of liquid phases is relevant.

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1 Simulation of a fluid stream.