



MODELING AND SIMULATION OF WATER JET-GUIDED LASER RADIATION

Task

In addition to passing through glass fibers, laser radiation can also be guided by a water jet. When materials are micro-machined with short pulsed radiation, this type of beam guidance has special advantages. Connected with this technology, however, are relevant issues of water jet stability and diffraction or scattering of guided radiation, all of which need to be examined or described numerically since the apparatus itself is inaccessible for direct measurement of these phenomena.

Method

Having successfully described the free surface of the water jet with full spatial resolution in order to identify hydrodynamic instabilities, Fraunhofer ILT is now examining the beam propagation inside the water jet by using the proven techniques of modeling and simulation. For this purpose, various equations

of beam propagation are solved for the media of air and water, namely a model formulation on the scattering of the radiation by the particles contaminating the nozzle chamber and a formulation for the diffraction of the radiation within the propagation along the resulting water jet.

Result

The institute has successfully conducted both the beam propagation in the water jet as well as in the water chamber and adjacent jet.

Applications

Both of the developed simulation techniques can be applied to beam propagation issues in fibers as to scattering problems.

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- 2 Scattering simulation in the area of the nozzle body.
- 3 Intensity profile at the exit of the water fiber.
- 4 Simulation of the beam propagation along the water fiber.