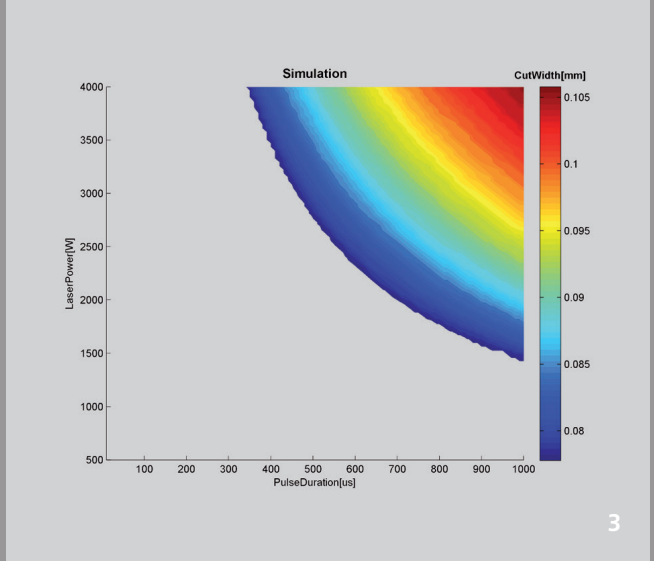

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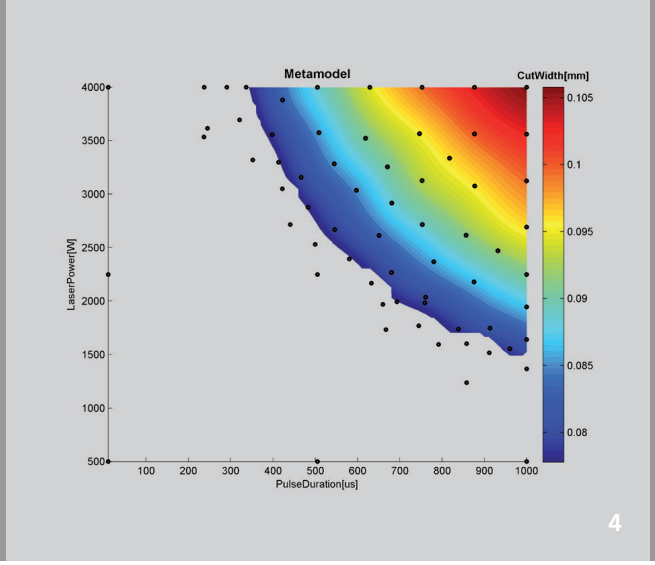

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METAMODELING FOR ANALYSIS OF MULTI-DIMENSIONAL PARAMETER DEPENDENCIES

Task

The physical limits (e.g. the so-called cut-off during laser cutting) of laser manufacturing processes are, on the one hand, important to understand the process. On the other, they must also be recognized within the scope of numerical modeling. This way, models for representing parameter dependencies (so-called meta-models) and their analysis can restrict/focus on the physically and technically sensible range of parameter space, i.e. to the area where a cut is possible at all.

Method

Recognizing detection limits of processes has, therefore, been pursued in the context of meta-modeling, because it plays an important role in the sensing of the parameter space (the so-called sampling) by means of simulations or real experiments. This detection is iteratively operated during the scan of the parameter space with corresponding process simulations.

Result

Fraunhofer ILT has developed so-called smart sampling methods to scan, adapted to a process, the multi-dimensional parameter space of a laser manufacturing process. These methods are based on subdividing the parameter space according to the classification in feasible and non-feasible domains. Smart Sampling recognizes feasible domains automatically and will only increase sampling of the parameter space in them with simulations, thus ensuring an improvement of the model quality.

Applications

The procedure of Smart Sampling developed here is applicable to all purposes of the »design of experiments« (DOE), whereas numerical experiments are also to be understood as experiments.

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3 Simulation forecast made out of 10,000 numerical simulations.

4 Metamodel forecast made out of 65 sampling points (black dots).