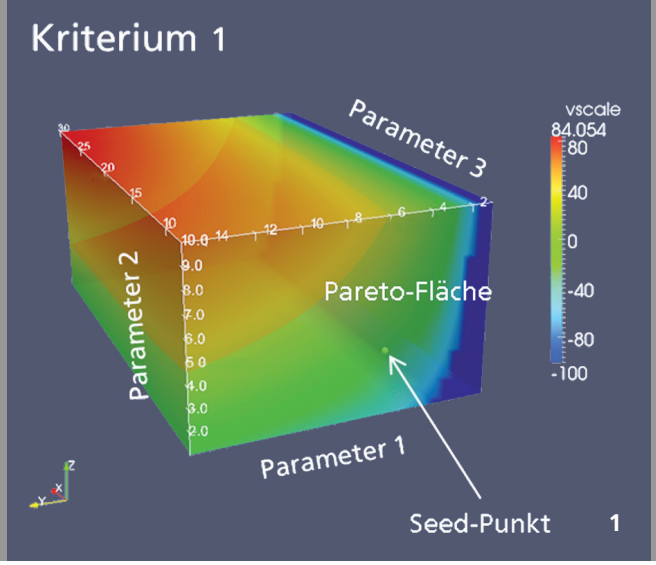

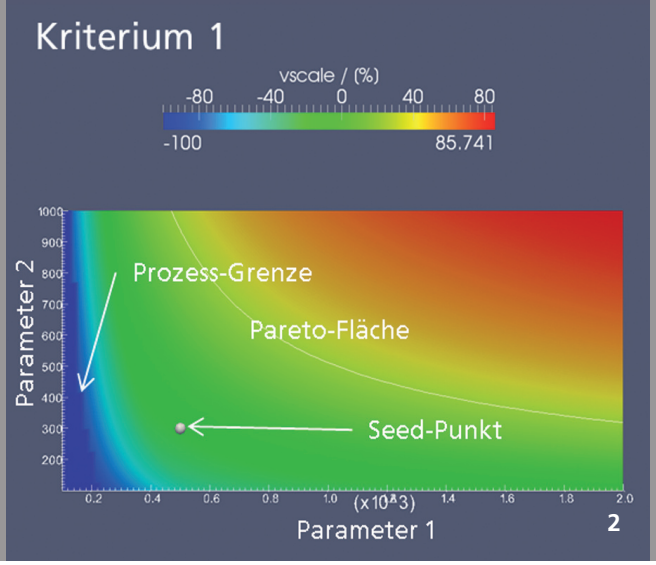

METAMODELING

Task

The practical use of scientific results from computer simulation and experimentation requires the results from simulations and experiments to be assembled in such a way that the data become fully explorable.

Method

The metamodeling technique enables individual simulation results to be combined to create a single process model within which experimental data can be stored and the results can be subsequently presented clearly in a way that allows them to be explored. The metamodel data can also be retrieved directly on a production machine and used for control purposes. This principle is currently being illustrated as part of the Integrative Production Technology for High-Wage Countries cluster of excellence at RWTH Aachen University using a laser cutting machine as an example. In addition to multidimensional function approximation techniques, metamodeling also uses Design of Experiment (DOE) methods and multidimensional optimization techniques.

Result

Proprietary tools for visualizing response surfaces (MeMoViewer) and plugins for the familiar VTK (Visualization Toolkit graphics standard have been developed. Algorithms for locally inverting the functional relationship between parameters and criteria (inverse problem) have been implemented and can be accessed for the exemplary process models chosen so far. As the next stage the Virtual Production Intelligence (VPI) concept devised in the cluster of excellence will be implemented.

Applications

The procedure described can be applied to any type of modeling for analyzing and optimizing a static or dynamic system. It provides users with a process map that they can use to find their way around in the high-dimensional parameter space in order to locate specific points of interest that would be more difficult to pinpoint without this kind of assistance.

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Illustration of an exemplary high-dimensional process model:
1 In a three-dimensional slice of the parameter space.
2 In a two-dimensional slice of the parameter space.