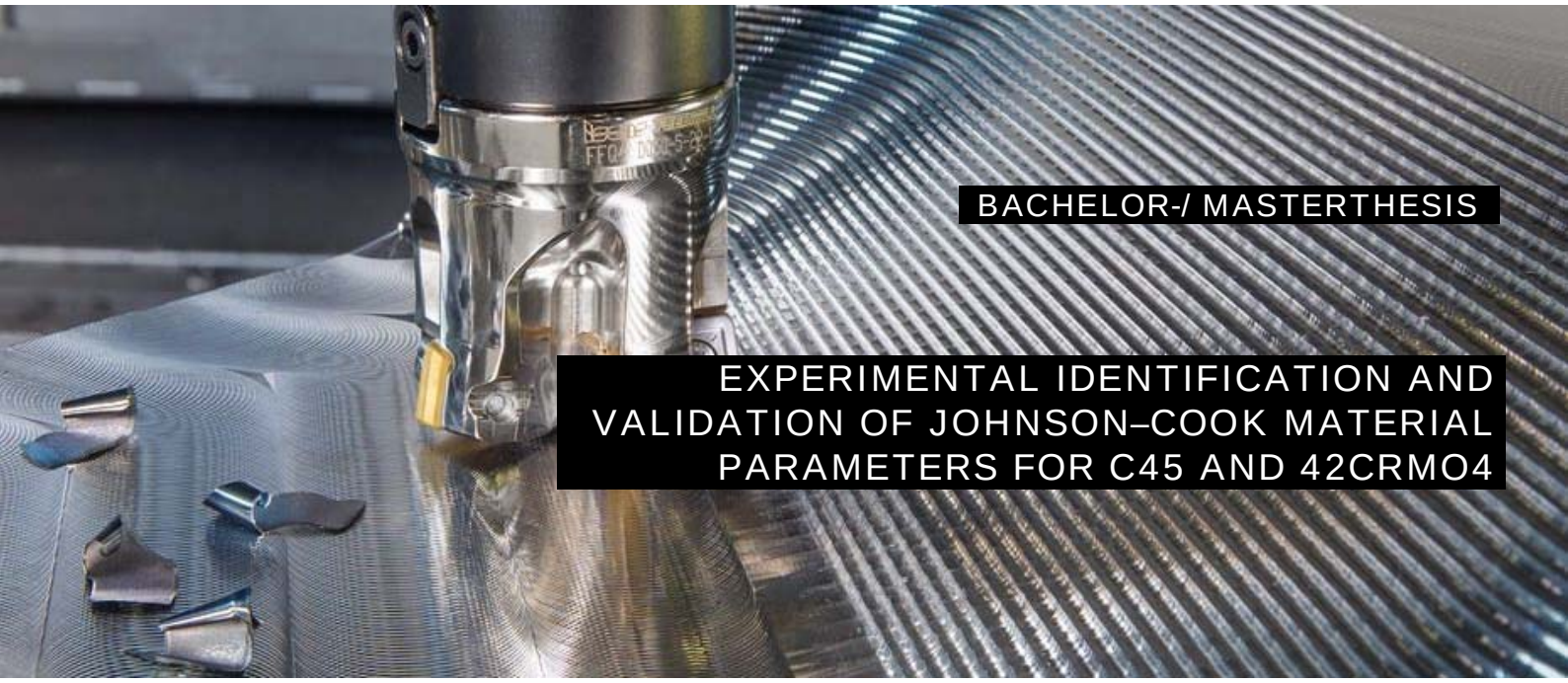
Karlsruher Institut für Technologie

Institut für Produktionstechnik



BACHELOR-/ MASTERTHESIS

EXPERIMENTAL IDENTIFICATION AND VALIDATION OF JOHNSON–COOK MATERIAL PARAMETERS FOR C45 AND 42CRMO4

DESCRIPTION

Accurate material models are essential for the numerical simulation of manufacturing processes involving large plastic deformations, high strain rates, and elevated temperatures. In particular, machining processes are characterized by complex thermomechanical loading conditions that strongly influence the deformation behavior of the workpiece material.

The Johnson–Cook material model provides a widely used approach for describing the plastic behavior of metallic materials by considering strain hardening, strain-rate sensitivity, and thermal softening.

In this thesis, the material behavior of the steels **C45 and 42CrMo4** will be experimentally investigated and suitable Johnson–Cook material parameters will be identified. Based on mechanical testing and the resulting stress–strain data, the relevant model parameters will be determined using appropriate data-processing, curve-fitting, and optimization methods.

Depending on the scope of the thesis, the identified material parameters will subsequently be implemented in a finite element model and evaluated with respect to their suitability for the numerical simulation of manufacturing processes.

The overall objective is to establish reliable Johnson–Cook parameter sets for C45 and 42CrMo4 and to develop a systematic methodology for their experimental determination and numerical validation.

TASKS

- Experimental characterization of the mechanical behavior of C45 and 42CrMo4 .
- Evaluation of stress–strain data and identification of the Johnson–Cook material parameters using curve-fitting and optimization methods
- Implementation and validation of the identified material models in a finite element simulation and investigation of their influence on the simulation results

FURTHER INFORMATION

Start: flexible / immediately possible

Duration: 3–6 months

Tools: Python, Marc Mentat

Location: Institute / laboratory

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