Karlsruher Institut für Technologie

Institute of Vehicle System Technology
Institute Mobile Machines

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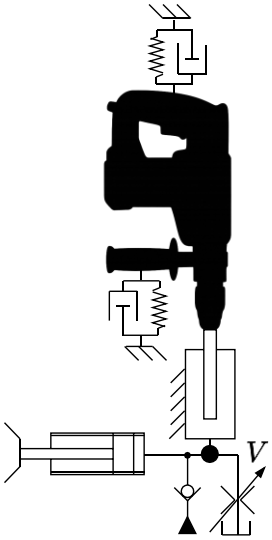
MOBIMA
MOBILE ARBEITSMASCHINEN

Bachelor's Thesis

Conceptual and Mechanical Design of an Equivalently Effective Hand-Arm Surrogate Model for Rotary Hammers



The dynamic behaviour of a rotary hammer during operation is influenced not only by the substitute, but also by its mechanical coupling with the operator. Grip and feed forces, as well as the inertia of the human arm, can affect the motion of the rotary hammer.

A hydraulic substitute base is being developed at the Institute Mobile Machines for repeatable testing of rotary hammers. It reproduces mineral substrates in an equivalently effective manner. To test the rotary hammer on the test rig under realistic conditions, a mechanical hand-arm surrogate model will represent the coupling between the rotary hammer and the operator.

The aim of this Bachelor's thesis is the conceptual and mechanical design of such a hand-arm surrogate model. The operator's hands and arms at the two handles of the rotary hammer will be represented by suitable spring-damper systems. Existing hand-arm models and suitable parameters from the literature will first be investigated. On this basis, spring stiffnesses and damping coefficients will be specified so that the model is equivalently effective to the human hand-arm system. A mechanical solution will then be developed. The result will be a buildable design including suitable components, dimensioning, a CAD model and technical documentation. This will provide the basis for subsequent assembly and experimental testing.

The following work steps are planned:

- Literature review of existing hand-arm models
- Analysis of the dynamic coupling between operator and rotary hammer
- Definition of suitable target quantities for assessing equivalent effectiveness
- Selection or development of a spring-damper model for both handles
- Determination of suitable spring stiffnesses, damping coefficients and, if required, equivalent masses
- Evaluation of model behaviour using analytical or simulation-based investigations
- Definition of test-rig requirements
- Development and assessment of suitable design concepts
- Sizing and selection of the required components
- Creation of a CAD model and the required manufacturing and assembly documentation
- Assessment of the design with regard to repeatability and technical feasibility
- Documentation and presentation of results

- **Start: From September 2026 or later**
- **Duration: 3 months**

If you are interested in this thesis, please feel free to contact me. The scope can be extended or adapted to suit your strengths and preferences.

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