

Bachelor's / Master's Thesis

Development and Evaluation of Concepts for Measuring the Velocities of Percussive Components in Demolition Hammers

Demolition hammers, such as hand-held rotary hammers and excavator-mounted hydraulic breakers, break up mineral materials by means of highly dynamic impact pulses. The velocities of the components involved in the impact process and of the chisel are important parameters for characterising operating behaviour. They can be used to determine, among other things, the transmitted impulse, impact energy, and energy transfer between the individual bodies.

Measuring these velocities poses a particular challenge. Whereas the chisel is accessible from the outside, the other percussive components are located inside the demolition hammer. Further challenges include high velocities and accelerations, short impact durations, limited installation space, and severe mechanical loads.



The aim of this thesis is to develop and evaluate different measurement concepts for determining the velocities of the chisel and the internal percussive components. Separate approaches will be developed for rotary hammers and hydraulic breakers. Both direct and indirect measurement methods will be considered. For hydraulic breakers, for example, the time history of the gas pressure in the gas spring could be used to determine striker motion using a model-based approach. Other possible approaches include capacitive, inductive, magnetic, or optical measurement methods.

The following work steps are planned:

- Research on rotary hammers, hydraulic breakers, and highly dynamic impact processes
- Research on existing methods for measuring velocities of highly dynamic bodies
- Definition of measurement requirements, including range, time resolution, accuracy, installation space, and robustness
- Development of measurement concepts for the externally accessible chisel
- Development of measurement concepts for internal rotary-hammer components
- Development of measurement concepts for internal hydraulic-breaker components
- Evaluation and comparison of the concepts using suitable criteria
- Selection and elaboration of a preferred concept
- Documentation and presentation of results

The exact scope will be adapted to the type of thesis. For a bachelor's thesis, the emphasis will be on systematic concept development. For a master's thesis, selected measurement principles should, where possible, be investigated experimentally using a test setup.

Type of thesis:

- Focus: Metrology, impact dynamics
- Fields: Rotary hammers, hydraulic breakers

Start and duration:

- From September 2026 or later
- Duration: 3/6 months

Requirements:

- Ability to work independently, systematically, and scientifically

If you are interested in this thesis, please feel free to contact me.

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