

# Bachelor thesis

## Characterization of Controlled Single Electrical Discharges and Resulting Damage in Rolling-Element Bearings

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### Background of the topic:

Rolling element bearings are widely used in electric drives, industrial machines, and renewable energy systems. In these applications, electrical phenomena can lead to unintended discharge events that may influence bearing performance and lifetime. Understanding how such discharges occur, how much energy they transfer, and under which conditions damage begins is important for improving reliability and design. This thesis addresses this topic through a combination of simulation, measurement (experiment), and analysis.

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### Objectives of the project:

The goal of the thesis is to study the relationship between electrical discharge parameters and the resulting energy delivered to a bearing. The work aims to develop a quantitative model, compare simulation and experimental results, and identify conditions under which measurable surface damage may occur. The findings should contribute to a better understanding of discharge-related bearing degradation.

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### Main Task descriptions:

- Conduct a literature review on electrical discharge effects in bearings and related damage mechanisms.
- Develop or adapt a simulation model of the discharge circuit.
- Perform experimental measurements under defined operating conditions.
- Analyze voltage, current, and energy data from the tests.
- Evaluate the influence of different parameters on discharge behavior.
- Inspect tested bearings for signs of surface modification or damage.
- Compare results with relevant literature and summarize the findings in a thesis report.

**Requirements:** To take part in this project, the student should have at least basic knowledge of electric circuits, measurements (ETP II), simulation tools, electric machines ('Elektrische Maschinen und Antriebe'), scientific writing skills and ability to work independently.

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### Date and organizations:

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