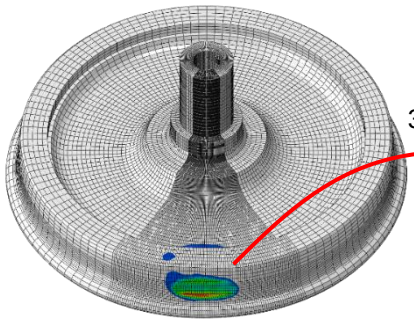
Masterarbeit zu vergeben

FEM-based Design and Vibration Analysis of Wheel Flat Geometries in a Downscaled Railway Test Rig

FEM-basierter Entwurf und Schwingungsanalyse von Flachstelle-Geometrien in einem verkleinerten Eisenbahnprüfstand

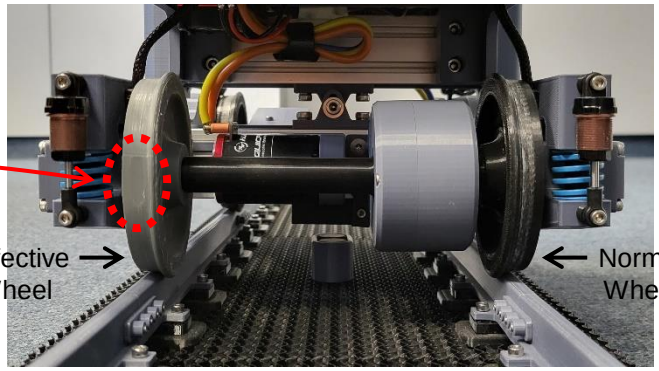
To successfully implement machine learning-based fault detection approaches, it is essential to have a high-quality dataset that meets a specific application purpose and requirements. However, due to practical limitations, it may be difficult to obtain a sufficiently large and diverse dataset in a short period of time by relying solely on field testing. In addition to simulation-based approaches, downscaled test rigs have been widely used in laboratory environments as an alternative. To generate vibration signals caused by vehicle and infrastructure faults, a 1:10 scale railway test rig was constructed using Fused Deposition Modelling (FDM) 3D-printing. During the downsizing and construction process to ensure a sufficient level of similarity between reality and a test rig, careful attention is required. If this is not taken into account, a dataset may be of poor quality and may not align with reality.

This study aims to design the 3D geometry of wheel flats and simulate defect-induced vibrations using the Finite Element Method (FEM) to better approximate actual vibration signals for better similarity, rather than just approximating the actual geometry of wheel flats. After comparative analysis, a selected wheel flat model should be defined as a function of the length or depth of a wheel flat and as a shape that can be well printed using FDM 3D-printing.



Simulated Wheel Flat
using SIMULIA Abaqus

FDM
3D-Printing



Source: CDFEB e.V.

Knowledge of the following lectures is advantageous:
„Vehicle Dynamics“, „Finite Element Method“, „Signal Processing“

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