



## Master Thesis

Experimental, Programming

### Machine learning-based grey-box modeling of Lamb wave propagation

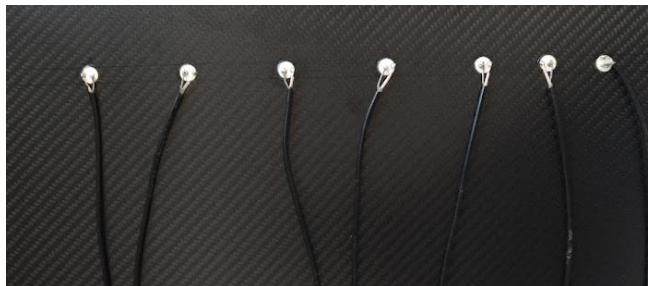
Keywords: Acoustic Emission, Machine Learning, Wave simulation

#### Conditions:

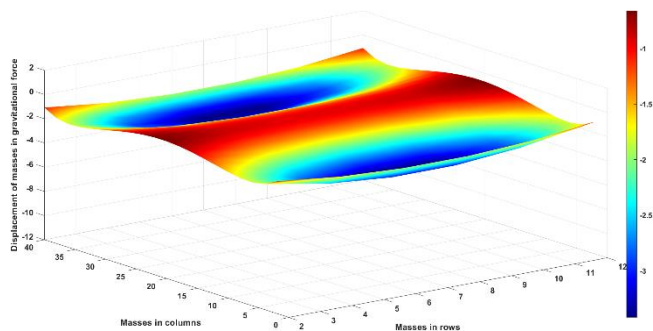
Duration: 6 months  
Requirements: MATLAB knowledge  
Language: English/German  
Target group: Master students

#### Contents:

In context of Structural Health Monitoring, Acoustic Emission is used as a nondestructive testing method. In case of mechanical damages in CFRP energy is released in form of elastic waves. These waves are called Lamb waves and can be measured by piezoelectric transducers. Damage assessment and localization is possible by analyzing the measured signals. The complex propagation behavior of Lamb waves in CFRP makes an analysis difficult. With this master thesis a spring mass damper (MDK) system should be configured and trained to simulate the propagation of Lamb waves.



First, experiments must be conducted to measure the propagation behavior of Lamb waves. Suitable signal processing and filter methods must be chosen to extract relevant features. The MDK system has to be optimized and the model parameters have to be trained based on an appropriate strategy. Finally, the simulation model has to be verified. Thus new experiments have to be designed and conducted. The measured data must be compared with the model output.



The goals of this work are:

- Measurement of Lamb wave propagation in CFRP material
- Preprocessing of data using filters for feature extraction
- Implementation and optimization of an existing MDK system
- Adaptation of the parameters to fit the real measured data
- Verification of the model adaptation by different test cases evaluating the prediction
- Complete and detailed documentation/presentation of the research results

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