Universität Rostock Traditio et Innovatio

CHAIR OF LIGHTWEIGHT DESIGN
Lehrstuhl für Leichtbau

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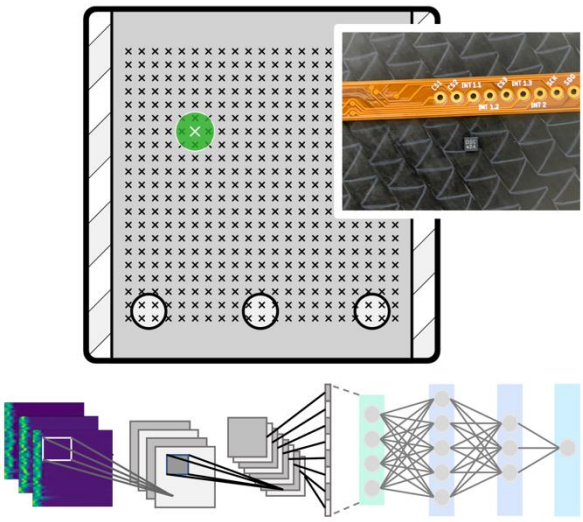
Development of an automated mechanical testbed for efficient experiments on smart composites

(Studien-/ Masterarbeit)



Sensor and actuator integration is currently an important research topic in lightweight design. One area of interest are smart structures or smart composites that are able to interact with their environment, act as an interface to the user, and monitor their loading or structural health. The integration of sensors into composite structures is facilitated by digital MEMS (microelectromechanical systems) sensors, which are widely used in many fields of technology. However, compared to other sensors, such as piezoelectric sensors for acceleration measurements, they have much lower signal and time resolution. Therefore, novel signal analysis approaches are required to enable their use in practical applications. Artificial neural networks have proven to be very useful to analyze and process sensor data in such situations. To develop and train such models, a large number of data points is required, so automation of experiments has to be considered.

The goal of this work is to develop an automated testbed for training artificial neural networks for smart composites. The testbed should perform low-energy impact tests on flat composite components, measuring signals from sensors integrated into the composite structure. The automated test bed is expected to enable the generation of more than a thousand experimental data points per hour. The study includes the following tasks

- Literature study on sensor integration in composites, especially data-driven sensor data analysis
- Build-up of a composite plate with MEMS sensors on printed circuit board; connection to micro-controller for data logging
- Design and implementation of CNC testbed with impactor device for small weights
- Control interface for the interacting automation of positioning, impacting and data logging
- Development of a data pipeline for storing, filtering and processing of the acquired sensor data

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