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Development of a model for the simulation of long-term data for bridge structures

Bridges are important infrastructure components and as such must not be allowed to fail. As they are exposed to constant, changing loads, they must be regularly inspected and repaired. To support these efforts, the "Structural Health Monitoring" project was launched at the Helmut Schmidt University. Part of the project was the installation of sensors on selected structures to enable continuous monitoring. In order to draw conclusions about the condition of the structure from this sensor data, consisting of acceleration, strain or inclination measurements, the signals must be pre-processed. Signal processing, modal analysis and machine learning methods are used here. Difficulties arise, among other things, from the fact that external influences have a considerable effect on the measured values. This can be noticeable, for example, through changes in the natural frequencies as a result of temperature changes. Changing, unknown traffic loads also lead to different excitations, so that it is not possible to draw conclusions about the bridge condition from individual sensor values.

The analysis methods must therefore be robust against these influences. Numerical models can be used to test the methods. The subject of this work is the development of a bridge model for the generation of long-term data. Influences such as annual temperature changes, changing traffic loads and stochastic wind loads are to be modelled. The TU1402-FE model, which is fully parameterisable, serves as the basis. It is also possible to simulate damage. The aim of the work is to obtain a model that is as flexible as possible and can be used to validate existing long-term monitoring systems.

Tasks:
- Literature research on simulation methods for (stochastic) loads
- Development of simulation methods for corresponding loads
- Development of a concept for long-term simulation
- Extension of the existing model
- Documentation

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