Uncertainty and Artificial Intelligence in Structural Analysis

Dr. Steffen Freitag

Georgia Institute of Technology

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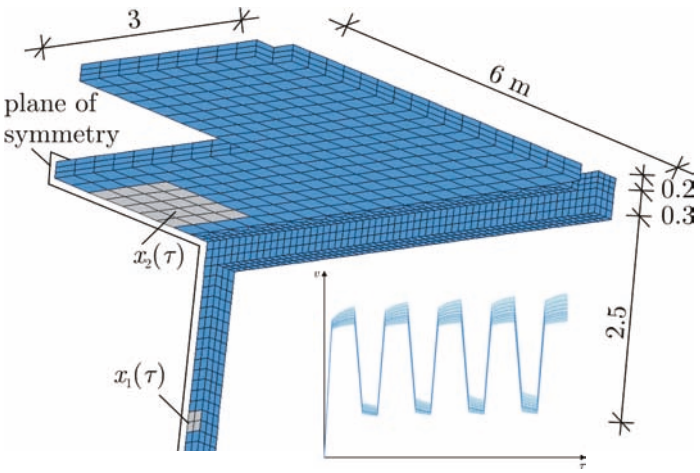
Structures should be resistant against a multiplicity of environmental actions during their lifetime. The applications of new materials in engineering practice as well as the evaluation of existing structures require knowledge about the time-dependent behavior. Structural monitoring is a possibility to get information. In addition to in situ monitoring of existing structures, numerical or real tests can be performed to investigate time-dependent material and structural behavior. The obtained data sequences can be used to identify structural parameters, which are required to predict structural responses and to assess serviceability, reliability, and lifetime.

If limited and only imprecise information is available for the selection of adequate physical models and the identification of their parameters, soft computing methods can be utilized. Artificial neural network concepts are presented, which can be applied to identifydependencies between structural actions and responses from uncertain measured data or results of numerical simulations. Recurrent neural networks for fuzzy data have been developed to map imprecise data series, which are represented as fuzzy processes. Swarm intelligence can be applied to identify deterministic or fuzzy network parameters within an inverse analysis.



Applications for the developed neural network approaches are presented. Recurrent neural networks for fuzzy data can be used, e.g. as material formulations or as surrogate models within finite element analyses. Fuzzy and fuzzy stochastic analyses can be performed for structural reliability assessment.

Guests are sincerely welcome!