Combination of Simulation Models and Deformation Monitoring in Structural Mechanics

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Abstract:

The performance and the reliability of engineering structures, e.g. bridges, tunnels or buildings, have to be assessed by structural models, which are used to compute the structural response (e.g. displacements and stresses of the structural components) according to the expected loads and environmental conditions. This includes not only the final structural state but also the construction process. Additionally, the health state of the structure may change during its lifetime, which needs to be considered within the reliability and safety assessment. In general, the structural response can be represented as time-variant processes of structural quantities of interest, which are dependent on the time-variant loads and material parameters.

Deformation monitoring is an important approach to observe the structural state during construction and during the service life of the structure. Real-time applications enable to compare continuously monitored deformation data with a priori computed deformations and to check specific threshold values, e.g. within a structural warning system. In addition to structural inspections, deformation monitoring can help to assess the structural health state or to identify unknown load and boundary conditions of the structural models. This requires to combine deformation monitoring with structural simulation models, which is the focus of this presentation. To achieve real-time performance of computational expensive simulation models, surrogate modeling strategies based on artificial neural networks will be presented. Additionally, the consideration of uncertainties will be discussed.

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