System Reliability Analysis Using Monte Carlo Based Method And Neural Networks

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Abstract

This paper examines and develops a method for calculating the probability of structural failure by using Monte Carlo simulation and combining it with a neural network approach. In order to assess the validity of this method, a simple concrete beam model with a corrosion crack is built in COMSOL Multiphysics®. This type of crack is typically has a constant width and varies in length. The beam is subjected to an external moving load and from the vibration resulting from that load, the crack length can be estimated. A second model, of a steel bar, reinforced concrete beam, also developed using COMSOL Multiphysics®. In this model, we calculate the deflection and axial stress. Different actions, e.g., dead load, live load, and wind, are applied to the beam and from deflection measurements, the probability of failure is calculated.
In this work FEM based COMSOL Multiphysics® has been used to simulate the model. The beams were built using the Structural Mechanics and Geomechanics Modules. COMSOL Server™ is then used to create a link with MATLAB® where the neural networks approach is developed to approximate the structural response and calculate the failure probability of the structure. Such analysis assists us to better understand and test the safety of Concrete Beams