Determination of statistical material parameters of concrete using fracture test and inverse analysis based on FraMePID-3PB tool

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Abstract

The stochastic non-linear computational mechanics faces in real-world application problems a fundamental obstacle – the lack of the knowledge of basic random variables involved in the problem. The direct experimental testing, often performed as compression test on cubic specimens, provides incomplete information about mechanical and fracture parameters and the lack of information is often substituted by an engineering judgment or by the information from literature. One possibility is to get parameters of computational model indirectly – based on inverse analysis.

The paper describes a methodology to get such parameters using experimental data of three-point bending tests used in inverse analysis based on combination of artificial neural networks and stochastic analysis (Novák and Lehký, 2006). Since the whole procedure is time consuming and complicated from data handling and artificial neural network training point of view a software tool FraMePID-3PB has been developed to automate the whole identification task.

Depending on sample size of statistical set, statistical characteristics of material parameters being identified can be determined using two approaches: (1) “One by one” approach – parameters of each specimen are identified separately and final statistics are calculated from the set of all values for each parameter. (2) “Direct approach” – in case of larger statistical set it is more efficient not to identify each specimen step by step but to identify the whole statistical set for all specimens together based on random response of fracture tests [2]. Both approaches were used for random material parameters determination of concrete specimens casted and tested in cooperation with Bautechnische Prüf- und Versuchsanstalt GmbH and BOKU University, Vienna, Austria.

References

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