Brittle Matrix Composites: Design of UHPC using artificial neural networks

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Ultra-high performance concrete (UHPC) results from the mixture of several constituents giving rise to a highly complex material in hardened state. The higher number of constituents in relation to current concrete, together with a higher number of possible combinations and relative proportioning, makes the behavior of this type of concrete more difficult to predict. Until now, most of the proposed mixture design methods are based on a trial and error procedure, which is expensive and work intensive. Moreover, these methods are not efficient in predicting neither the consistency in fresh state nor the strength in hardened state, and do not consider the effect of curing on the latter. The main objective of the research study herein described is to build an analytical model, based on artificial neural networks (ANN), to predict the required performance of UHPC. Specifically, back-propagation neural networks (BPNN) are adopted to model the relation between the input and the output parameters of UHPC, for two different curing conditions, including heat treatment and water storage. In order to train the neural network, a total set of 53 different mixtures were designed. It is concluded that the developed model can be used as a reliable method to predict the performance of UHPC.

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