Building Strength Models for High-Performance Concrete at Different Ages Using Genetic Operation Trees, Nonlinear Regression, and Neural Networks

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Abstract

Because the behavior of HPC at early age may be rather different from at late age, this study proposed to establish the strength models of HPC at different ages, and to explore the difference between these models. A large number of experimental data were used to compare accuracy of the three model building techniques, nonlinear regression analysis (NLRA), back-propagation networks (BPN), and genetic operation trees (GOT). The results showed: (1) When NLRA was employed to establish the prediction model, the approach to establish HPC strength models based on the three separate data sets was more accurate than that used to establish HPC strength models for the total data set. (2) If an explicit formula is necessary, GOT is the best choice to build concrete strength models at medium and late ages (i.e., more than 14 days), while NLRA provides greater accuracy at early ages (i.e., less than 14 days); otherwise, BPN is the best choice.

Keyword：high-performance concrete, nonlinear regression analysis, back-propagation networks, genetic operation trees.