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OPTIMAL PREDICTION OF THE FRACTURE PARAMETERS OF CONCRETE BASED ON ARTIFICIAL NEURAL NETWORKS

Nour Betoush[1], Ayah Alkhawaldeh[1], Nasser Al-Huthaifi[1], Mohammad Alhassan[2,3*]

[1] PhD Student, Civil Engineering Department, Jordan University of Science and Technology, Irbid, Jordan
nabetoush19@eng.just.edu.jo, aaalkhawaldeh17@eng.just.edu.jo, nkalhuthaifi19@eng.just.edu.jo
[2] Professor of Civil Engineering, Al Ain University, Abu Dhabi, UAE
[3]Professor of Civil Engineering, Jordan University of Science and Technology, Irbid, Jordan
mohammad.alhassan@aau.ac.ae

ABSTRACT

Determining the amount of energy required for crack propagation in concrete structures based on fracture mechanics principles is interesting. Fracture energy of concrete, as a quasi-brittle material, is an effective index for safe design of structures and failure behavior modelling. The nonlinear behavior of concrete in the fracture process is complex and there is a limited number of conclusive discussions on how to accurately predict the fracture energy using the existing estimating formula. Accordingly, this paper attempts to provide an innovative empirical approach for estimating the fracture energy of concrete. Based on a large quantity of experimental data, an artificial neural network (ANN) technique was used to construct connections between certain various effective parameters and specific fracture parameters, and therefore to predict the related fracture parameters. The fracture parameters of major interest in this study were the fracture energy (Gf) and stress intensity factor (K). The developed ANN-based prediction model combined the influence of the most significant characteristics influencing the fracture parameters with many important parameters never considered before. For simplicity, the required coefficients for predicting the fracture parameters using the developed model were provided in a user-friendly formula.

KEYWORDS: Stress Intensity Factor; Fracture Energy; Artificial Neural Networks; Sensitivity Analysis.

* Corresponding and presenting author
Professor and Director, Civil Engineering Program
Al Ain University (AAU), Al Ain - UAE
Tel: +971508752400
E-mail: mohammad.alhassan@aau.ac.ae