NCON-PGR_2022_021

Prediction of Concrete Residual Compressive Strength under Elevated Temperatures: Response Surface Methodology (RSM) Approach

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Abstract

Exposure of concrete to elevated temperatures causes irreversible damage to the concrete structure and poses a serious threat to the service life of the concrete. Owing to the importance of concrete fire performance, many researchers have extensively studied the behavior of concrete under elevated temperatures with different conditions. The properties of concrete have been significantly affected by the distinct heating and cooling conditions, which include heating temperatures, heating durations, and cooling methods. The residual compressive strength of concrete is considered the most important characteristic after being exposed to elevated temperatures. In this paper, the present works targets to develop the mathematical models for analyzing and predicting the residual compressive strength of concrete at high temperature. Three independent factors were identified in this study, which are heating temperatures, heating duration, and cooling method. Two groups of datasets on the residual compressive strength of concrete under elevated temperatures were reviewed and collected from previous studies and were set as the benchmark dataset and validate dataset, respectively. Response Surface Methodology (RSM) was used to analyze the dataset. The results of various statistical parameters, such as coefficient of determination, sum of square, F-value, and P-value, indicate the significant of predicted model for predicting concrete residual compressive strength under elevated temperatures. From the RSM analysis, the factor of heating temperatures has the most significant effect on the residual compressive strength of concrete. In short, RSM model correlate well with those validate dataset with a coefficient of determination (R^2) of 0.8547

Keywords: Concrete; Elevated temperature; Prediction; Residual compressive strength; RSM.