

Relative research contributions towards the application and materialization of Wenner four-point method on concrete curing: sensitivity analysis of neural network inputs

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Abstract

Concrete is one of the most widely used materials in construction. This is due to the numerous advantages it offers in terms of durability, versatility and cost, among others. Cement is the hydraulic binder of concrete, so the compressive strength depends, to a large extent, on the chemical reaction of cement hydration [1]. Consequently, this publication deals with the determination of the compressive strength of concrete during the cement hydration process, and the prediction at early ages of the compressive strength at day 28.

In the chemical reaction of the cement hydration process tricalcium silicate, dicalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite react with water to form ettringite, calcium hydroxide and calcium silicate gel [2]. In addition, an internal structure of capillaries and cavities arises with ions dissolved in the water acting as a reagent. Under these conditions, when an electric field is applied, an accelerated movement of ions occurs.

With this concept, a system capable of measuring the ions through the electrical resistivity measurement has been developed. The developed system is an own hardware development based on Wenner's four-point method. Throughout the development of the hardware, a study of the optimal electrode design, excitation methodology, power supply system and communication system has been carried out.

Once the way to measure the electrical resistivity of the concrete has been established, an algorithm based on artificial intelligence has been developed to determine the relationship between resistivity and compressive strength. As well as the methodology to predict at early ages the value that the compressive strength of the concrete will acquire on day 28. Throughout this work it has been necessary to carry out a sensitivity analysis of the different variables used as input for the prediction, and the results of this study are presented in this article.

References

- [1] College of Resource and Environment, S. U. (2016). High-performance superplasticizer based on chitosan. *Biopolymers and Biotech Admixtures for Eco-Efficient Construction Materials*, 131-150.
- [2] Yuan, Y., & Ji, Y. (2009). Modeling corroded section configuration of steel bar in concrete structure. *Construction and Building Materials*, 23(2461-2466).

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