

Artificial Neural Network Based Design and Modeling of Composite Building Materials from Industrial Waste – A Study for Environmental Sustainability

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Abstract:

The need for sustainable alternatives in building materials has increased due to the environmental impact of cement production. A data-driven methodology for designing and predicting the strength of composite construction materials that partially replace ordinary Portland cement (OPC) with industrial slag is shown in this paper. An Artificial Neural Network (ANN) model was developed using experimental datasets that included compressive strength at various curing ages, workability (fluidity), replacement ratio, and ox

ide composition (CaO , MgO , SiO_2 , and Fe_2O_3). When calculating compressive strength, the suggested multilayer perceptron network showed good predictive ability ($R > 0.95$). According to experimental findings, using up to 15% slag in place of cement improves 28-day compressive strength while having a negligible impact on early-age performance. In order to lower carbon emissions and material consumption, the study develops a sustainable materials design technique that combines the use of industrial waste with AI-based optimization. The suggested ANN framework promotes environmental sustainability and the optimization of environmentally suitable building materials.

Keywords:

Artificial Neural Network, Industrial Slag, Sustainable Materials, Cement Replacement, Compressive Strength Modeling.