Soran Abdrahman Ahmad, Rozhnw Omer Mustafa, Diyar Arif Saeed, Asa Omed Nadir, Hersh Hama Amin F Mahmood
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DATA-DRIVEN PREDICTION AND NORMALIZATION OF MECHANICAL PROPERTIES IN JUTE FIBER–REINFORCED CONCRETE

PROGNOZOWANIE I NORMALIZACJA WŁAŚCIWOŚCI MECHANICZNYCH BETONU ZBROJONEGO WŁÓKNAMI JUTOWYMI NA PODSTAWIE WYNIKÓW BADAŃ

Soran Abdrahman Ahmad*, Rozhnw Omer Mustafa
Diyar Arif Saeed, Asa Omed Nadir
University of Sulaimani, Iraq
Hersh Hama Amin F Mahmood
University of Halabja, Iraq

Abstract

Using fiber in the concrete is one of the methods to improve its capacity for the load resisting especially for the bending and tensile loading, but this process has two challenges, the first one is the energy usage, the waste gas emission which produced in these fiber's industry, while the second challenge is the increase in the solid waste materials in the land which is include natural plant fiber. The usage of natural fiber instead of these industrial fibers will have a double advantage. This article deals with investigating the effect of using jute fiber on the properties of concrete, also proposing statistical models to predict the compressive strength of concrete by collecting the experimental data from previous experimental work. By using three different models, including the quadrant support vector machine, Integration Linear, and squared exponential Gaussian, and using 80 experimental data points. Based on the obtained results between the proposed models to predict the compressive strength of concrete, SVM provides higher accuracy and efficiency compared to the other proposed models, when the value of the coefficient of determination is higher than the IL, and SEG by 10.98%, and 1.09% respectively.

Keyword: reinforced concrete, jute fiber, modeling, compressive strength

Streszczenie

Zastosowanie włókien w betonie to jedna z metod poprawy jego wytrzymałości na obciążenia, zwłaszcza zginanie i rozciąganie. Proces ten wiąże się z dwoma wyzwaniami. Pierwszym z nich jest zużycie energii i emisja spalin powstających w przemyśle włókienniczym, a drugim – wzrost ilości odpadów stałych w glebie, w tym naturalnych włókien roślinnych. Zastosowanie włókien naturalnych zamiast włókien przemysłowych przyniesie podwójną korzyść. Niniejszy artykuł analizuje wpływ zastosowania włókien jutowych na właściwości betonu, proponując również modele statystyczne do przewidywania wytrzymałości betonu na ściskanie poprzez zebranie danych eksperymentalnych z poprzednich badań laboratoryjnych, z wykorzystaniem trzech różnych modeli, w tym kwadrantowej maszyny wektorów nośnych (SVM), interakcji liniowej (IL) i gaussowskiej radialnej funkcji bazowej (SEG), a także 80 punktów danych eksperymentalnych. Na podstawie uzyskanych wyników pomiędzy proponowanymi modelami przewidywania wytrzymałości betonu na ściskanie SVM zapewnia wyższą dokładność i wydajność w porównaniu z innymi proponowanymi modelami, podczas gdy wartość współczynnika determinacji jest wyższa niż w przypadku IL i SEG, odpowiednio o 10,98% i 1,09%.

Słowa kluczowe: beton zbrojony, włókna jutowe, modelowanie, wytrzymałość na ściskanie

*University of Sulaimani, Iraq, e-mail: soran.abdrahman@univsul.edu.iq

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