

Investigation of Extreme Gradient Boosting Model Prediction of Soil Strain-Shear Modulus

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Abstract : One of the principal parameters defining the clay soil dynamic response is the strain-shear modulus relation. Predicting the strain and, subsequently, shear modulus reduction of the soil is essential for performance analysis of structures exposed to earthquake and dynamic loadings. Many soil properties affect soil's dynamic behavior. In order to capture those effects, in this study, a database containing 1193 data points consists of maximum shear modulus, strain, moisture content, initial void ratio, plastic limit, liquid limit, initial confining pressure resulting from dynamic laboratory testing of 21 clays is collected for predicting the shear modulus vs. strain curve of soil. A model based on an extreme gradient boosting technique is proposed. A tree-structured parzan estimator hyper-parameter tuning algorithm is utilized simultaneously to find the best hyper-parameters for the model. The performance of the model is compared to the existing empirical equations using the coefficient of correlation and root mean square error.

Keywords : XGBoost, hyper-parameter tuning, soil shear modulus, dynamic response

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