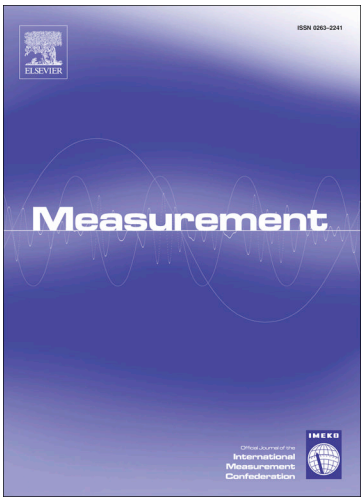

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Determination of strength and modulus of elasticity of heterogenous sedimentary rocks: an ANFIS predictive technique

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Abstract

The properties of sedimentary rocks, in term of strength and deformation, are significant for various purposes in different fields such as in mine planning and design, reservoir stability evaluation, surface and sub-surface structure designs. This study proposes suitable predictive models for estimation of unconfined compressive strength (UCS) and modulus of elasticity (E) of sedimentary rocks using easy and economically determinable key geomechanical properties. A total of 45 dataset of geomechanical properties including density, porosity, P-wave velocity (Vp), UCS and E were determined through rigorous laboratory tests on samples from Umrer sandstone, Singrauli sandstone and Kutch limestone. In proposed predictive models, density, porosity and Vp were considered as input parameters for prediction of output parameters (UCS and E) using adaptive neuro-fuzzy inference system (ANFIS). The prediction performance of ANFIS models checked through evaluating different membership functions. The suitability of models and their robustness examined by the coefficient of determination (R^2), and performance indices such as the mean absolute percentage error (MAPE) ,variance account for (VAF) and root mean square error (RMSE). Among the five proposed models for UCS, the model 3 was best suited with performance indices MAPE, VAF, and RMSE calculated as 16.53%, 95.60%, and 4.69 respectively and R^2 equal to 0.935. Model 3 was best suited for the proposed models for E with MAPE, VAF, and