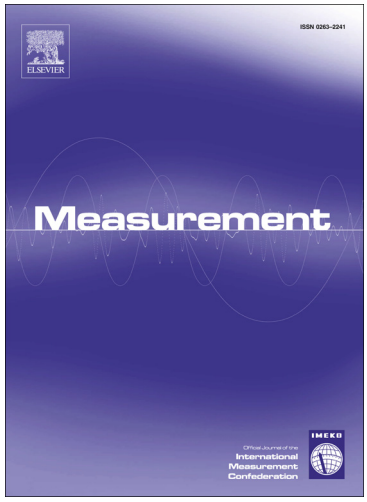

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Indirect measurement of the elastic modulus of intact rocks using the Mamdani fuzzy inference system

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Abstract

Elastic modulus of intact rocks (*E*) is one of the most important parameters in the initial and final design of rock engineering projects. Laboratory measurements of *E* require the high quality core samples and expensive tools which cause it is very costly and time-consuming. As an alternative, indirect models i.e., Mamdani fuzzy inference system (MFIS) and multiple regression analysis (MRA) are uses to determine E in this research. The proposed models are constructed based on the measured data in Azad and Bakhtiary dam sites. To estimate *E*, easily determinable variables including depth of coring, density, porosity and durability index are considered as the input parameters. Models evaluation shows that MFIS performance is considerably better than the MRA model and its results are quite consistent with measured data. Finally, sensitivity analysis reveals that density and depth of coring are the most and least effective parameters on elastic modulus in this study.

Keywords: Intact rock; Elastic modulus; MFIS; MRA

1. Introduction

Analyzing the intact rock performance as well as proper estimation of its related mechanical properties is extremely significant in planning of the most rock mechanics and geotechnical engineering projects. Elastic modulus of intact rocks (*E*) plays a fundamental role in both the primarily and ultimately design stages of rock engineering structures i.e., tunnel design, rock drilling and blasting design, rock slope stability analysis, rock pillar design, road projects, bridges and dams design. In addition, elastic modulus is the key parameter in analyzing of the rock cores stress-strain chart in the laboratory. Moreover, *E* is an essential variable in rock deformation and breakage analysis around the underground excavations. Therefore, imprecise estimation of this parameter (*E*) could be damaging and leads to budget losses and safety decreasing because of the breakage of structures under construction [1-4]. As a result, exact and quick determination of *E* is essential to proper

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