TIME DEPENDENT EVOLUTIONARY FUZZY SUPPORT VECTOR MACHINE INFERENCE MODEL FOR PREDICTING DIAPHRAGM WALL DEFLECTION

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Abstract: Brace diaphragm walls are commonly used in underground structures in metropolitan areas, where avoiding costly damage to adjacent infrastructure / buildings is critical to project success. It is necessary to make accurate diaphragm wall deflection predictions to ensure actual deflection falls within allowable limits, and thus ensure the safety of both the project and adjacent structures. Numerous studies and approaches, such as empirical, semi-empirical as well as numerical approaches, have addressed excavation-induced deflection in diaphragm walls. Artificial intelligence (AI) has been used recently by several researchers to improve diaphragm wall deflection prediction capabilities. This paper proposes a hybrid artificial intelligence system, namely the evolutionary fuzzy support vector machine inference model for time series data (EFSIM$_T$), to predict diaphragm wall deflection in deep excavation through the application of historical project data. Simulations were performed on 1,083 instances, segregated into a total of 988 training data sets and 95 test data sets. Validation results show that the EFSIM$_T$ achieves higher performance in comparison with Artificial Neural Networks and the Evolutionary Support Vector Machine Inference Model (ESIM). Therefore, EFSIM$_T$ has great potential as a predictive tool for diaphragm wall deflection problems and assisting project managers/engineers to ensure safety during the construction process.

Key words: *Diaphragm wall deflection, deep excavation, fuzzy logic, time series data, weighted support vector machines, fast messy genetic algorithms*

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