

A new approach for calculating 1D local velocity model using Particle Swarm Optimization technique

A new method for calculating 1D local seismic velocity model is proposed by using one of the powerful methods in global optimization techniques named Fuzzy Self-Tuning Particle Swarm Optimization (FST-PSO). It generates random particles (velocity models) in a pre-defined solution space in which after number of iterations they lead to a model that yields best fits to the data. Not using the partial derivatives of travel-times respect to model parameters and performing no matrix inversion, it enables to speed up the calculations. In addition, because the PSO family members use only random processes to generate new models, they are inherently stable and avoid all numerical problems encountered in deterministic methods. Taking advantage of fuzzy logics implemented, no parameters are needed to be adjusted including social, cognitive and inertia for running the program. The proposed methodology is very easy-to-use, effective and powerful. Its proficiency was checked on both synthetic and real datasets. This method was applied to calculated 1D velocity model of the Southern-part of central Alborz Iran, which its velocity model has already been calculated. The comparison between these two models shows a good correlation between them, while the reductions of RMS and hypocentral errors using the FST-PSO-model are obvious.

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