COMPARING GENETIC ALGORITHM AND PARTICLESWARM OPTIMAIZATION APPROACHES IN INVERSION OF SURFACE WAVE DATA

Rashed POORMIRZAEE
PhD Candidate, Sahand University of Technology, Tabriz, Iran
Rashed.poormirzaee@gmail.com

Ahmad ZAREAN
Assistance Prof., Islamic Azad University, ShabestarBranch, Shabestar, Iran
a.zarean@iaushab.com

Rasoul HAMIDZADEH MOGHADAM
Assistance Prof., Sahand University of Technology, Tabriz, Iran
rhamidzm@yahoo.com

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ABSTRACT

Shear-wave velocity (Vs) is an important parameter for site characterization in geotechnical and earthquake engineering studies.Shear-wave velocity is in situ measured by various methods including borehole tests, shear-wave refraction and reflection studies and surface-wave techniques. In recent years, surface waves have been increasingly used for deriving Vsas a function of depth. But, inversion is the key problem in processing surface wave data for estimating velocity of S-waves. In present study we applied two metaheuristic optimization approaches, Genetic algorithm (GA) and particle swarm optimization (PSO), for inversion of Rayleigh wave dispersion curves. GA and PSO are the global optimization methods that belong to metaheuristic searching algorithms. In geophysical surveys, the application of metaheuristic techniques is novel. After programming the GA and PSO in MATLAB, its efficiency was investigated by a synthetic model. At the end, GA and PSO inversion algorithms were tested on an experimental Rayleigh wave dispersion curve data which was collected for seismic hazard assessment in an area of city of Tabriz in the northwest of Iran. Real datasets were obtained from one stations in south part of Tabriz (near Elgoli Road) that contain Miocene –Pliocene and pyroclastic bedrocks. The results proved applicability of proposed inversion algorithms in Rayleigh wave dispersion curve inversion. Also, assessment of two inversion algorithms showed that PSO inversion algorithm, because of few parameters to adjust, is fast and easy to implement compared to GA inversion algorithm.

INTRODUCTION

Shear-wave velocity (Vs) is an important parameter for site characterization in geotechnical engineering (Renalear et al., 2010). In theory, Vs is a function of ground compactness and rigidity variations (Hunter et al., 2002). Also, Vs imaging techniques allow for the delineation of geologic boundaries in the subsurface. In earthquake engineering, ground motion characteristics including amplitude and duration are amplified in the sites where soft soil layers cover firm bedrock. This issue is in contrast to Vs values that strongly control dynamic site response and the resulting damage(Zarean et al., 2015). Shear-wave velocity (Vs) is in situ measured by various methods including borehole tests, shear-wave refraction and reflection