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基于粒子群优化算法的叠前角道集子波反演

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Wavelet inversion of pre-stack seismic angle-gather based on particle swarm optimization algorithm

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摘要

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摘要 本文探讨了粒子群优化(PSO)算法在叠前地震角道集子波反演中的应用.在基本最优PSO算法的基础上,提出了对粒子更新速度进行平滑滤波的改进最优粒子群算法.由于代表子波的粒子的维数较大,如果粒子的各维元素相互独立,将导致粒子速度更新紊乱,影响搜索速度.通过对粒子速度进行三点均值滤波,加强了单个粒子各维元素的相互联系,并防止了粒子速度逃逸,使粒子更快地向有利于最优解的位置收敛.该方法应用于叠前角道集子波的反演中,取得了较好的子波反演效果,证明了本文方法的有效性.

关键词 角道集子波; 叠前反演; 最优粒子群; 速度均值滤波; 全局优化

Abstract: A novel method for pre-stack seismic wavelet extraction based on particle swarm optimization (PSO) algorithm is presented in this paper. Under the framework of basic PSO algorithm, a mean filter is introduced for updating velocity of particles in order to obtain the inversion results of global optimal wavelet. Seismic wavelet vector is described in the form of particle that is composed of many elements. If elements of a certain particle are independent of others, the particle velocity updating will be in disorder, which will have an adverse effect upon the process of searching for the optimal moving trajectory of particles. Three-point mean filter is used in the process of particle velocity updating and in that way the relationship among the elements of a certain particle is strengthened, which avoid particle velocity shifting and particles converge to the optimal solution quickly. The proposed algorithm in this paper was successfully performed for wavelet extraction in real pre-stack seismic data, which demonstrates that the improved PSO algorithm is efficient and feasible in seismic wavelet inversion.

Keywords Angle-gather wavelet, Pre-stack inversion, Particle swarm optimization, Velocity mean filter, Global optimization

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