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朱童, 李小凡, 李一琼, 张美根. 基于改进粒子群算法的地震标量波方程反演[J]. 地球物理学报, 2011, V54(11): 2951-2959, DOI: 10.3969/j.issn.0001-5733.2011.11.025

ZHU Tong, LI Xiao-Fan, LI Yi-Qiong, ZHANG Mei-Gen. Seismic scalar wave equation inversion based on an improved particle swarm optimization algorithm. Chinese J. Geophys. (in Chinese), 2011, V54(11): 2951-2959, DOI: 10.3969/j.issn.0001-5733.2011.11.025

基于改进粒子群算法的地震标量波方程反演

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Seismic scalar wave equation inversion based on an improved particle swarm optimization algorithm

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摘要

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摘要 针对标准粒子群优化(PSO)算法存在易出现早熟而陷入局部最优以及进化后期收敛速度慢等缺陷,通过考虑粒子所处位置间相互作用,提出了一种改进的并行粒子群优化算法。由于引入粒子位置间的相互影响,减少了粒子搜索过程盲目性,因此能有效提高算法的收敛速度。数值试验表明,这种改进的粒子群算法适用于二维标量波方程的速度反演,且算法具有对初始模型依赖性低、收敛速度快、反演结果稳定、抗噪能力强等特点,为进一步将该反演算法用于弹性波波方程以及弹性参数反演提供了理论依据。

关键词: 改进粒子群算法 标量波方程 速度反演 并行

Abstract: In the standard particle swarm optimization (PSO), the premature convergence of particles and slow convergence in the late process decrease the searching ability of the algorithm. In this paper, by taking the positions of the particles into consideration, we propose an improved parallel particle swarm optimization (IPPSO) algorithm, which can increase the efficiency, to reduce the blindness in the search process. The performance of this improved particle swarm optimization method in solving 2-D scalar wave equation inversion problems is investigated. Our numerical experiments indicate that this method is suitable for scalar velocity inversion problems since it has merits such as low dependence on initial model, high constringency speed, stable result and strong antinoise ability. The results hold promise for further elastic wave equation and elastic parameters inversion studies.

Keywords: Improved particle swarm optimization Scalar wave equation Velocity inversion Parallel

Received 2010-10-16;

Fund:

国家自然科学基金重点项目(40437018)、国家自然科学基金(40874024)、国家重点基础研究发展计划(973计划)(2007CB209603)资助。

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链接本文:

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