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光线寻优算法的寻优机理分析

沈继红[1], 李加莲[2]

1. 哈尔滨工程大学理学院, 哈尔滨 150001;
2. 哈尔滨工程大学自动化学院, 哈尔滨 150001

The Optimal Mechanism Analysis of Light Ray Optimization

SHEN Jihong[1], LI Jialian[2]

1. College of Science, Harbin Engineering University, Harbin, 150001;
2. College of Automation, Harbin Engineering University, Harbin, 150001

- 摘要
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全文: PDF (467 KB) HTML (1 KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 光线寻优算法是一种通过模拟光的传播路径进行寻优的最优化方法. 该算法用网格划分可行域, 将具有不同折射率的介质填充到各网格中, 并将光在此变折射率介质中的传播路径设想成算法的寻优路径. 光线寻优算法仅用到目标问题的函数值, 结构简单容易实现. 根据费马原理, 利用变分法进行推导, 得出了光具有偏向折射率增大方向, 偏离折射率减小方向的自动寻优性质. 通过求解9个标准测试函数, 并将算法与模拟退火算法, 标准粒子群算法进行比较, 验证了所得结论以及算法的可行性, 有效性, 潜在的优越性.

关键词： 光线寻优算法 光线方程 寻优机理 方向导数 曲率

Abstract： Light ray optimization algorithm is an optimal method simulating the propagation path of light. In this algorithm, feasible region is divided by grids in which media with different refracitivities are put. Let the velocity of light rays in each medium be the value of objective function at some point in the division, and then a beam of light rays propagate in these media with the laws of refraction and reflection to search the optimal value automatically. Refraction and reflection merely occur on the boundary of grids, and light rays propagate along straight lines in the same grid. Only the function values of objective problem are used in light ray optimization, and it has the advantages of simple structure, few tuning parameters and easy tuning. According to Fermat's principle and variational method, the conclusions were reached that light will get closer to the direction that makes refractivity increase, and get further from the one that makes it decrease. The conclusions of light ray optimization were verified by solving nine standard test functions, and the algorithm also was compared with simulated annealing algorithm and standard particle swarm optimization algorithm. Feasibility, validity and potential advantages of the algorithm were verified by large quantity of numerical experiments.

Key words： light ray optimization algorithm light rays equations optimal mechanism directional derivative curvature

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