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用鱼群算法求解通风系统风机定位优化问题

黄光球, 姚玉霞, 陆秋琴

西安建筑科技大学 管理学院，西安 710055

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摘要 为了解决矿井通风系统风机定位优化问题，建立了该问题的大规模非线性最优规划模型。在优化模型中，在兼顾变量约束条件的空间限制和求解精度的情况下，在正交交叉算子中将求解空间离散化，离散方法是将每个连续因素离散化为一个有限值，量化每个变量连续空间区域为有限个水平。由于该问题维数太高，传统优化技术无法有效获取其最优解，采用改进的鱼群算法对该问题进行了求解。在算法中，为了消除优化模型的约束条件，大幅度压缩变量数，在算子中将变量分组；使用了基于邻域竞争进化的演化算法，有效地融合了全局搜索和局部搜索的本质属性，实现了算法效率与效果的平衡；使用了自适应学习和变异算子、正交交叉算子、邻域竞争算子等多种算子改进基本人工鱼群算法的各种行为。应用结果表明，该算法计算速度和稳定性大幅度提高，可在简单计算环境下稳定地获取该模型的最优解。

关键词 通风系统 风机定位 大规模非线性混合整数规划 鱼群算法

分类号

Locating optimization of fans in ventilation system based on fish-swarm algorithm

HUANG Guang-qiu,YAO Yu-xia,LU Qiu-qin

School of Management，Xi’an University of Architecture & Technology，Xi’an 710055，China

Abstract

In order to solve the optimization problem of location of fans in a ventilation system of underground mine，a large-scale nonlinear mixed integer programming model is established for this problem.In the optimization model，the solving space is discretized based on actual consideration of space constraints of variables and precision of solutions.The policy of discretization is to discrete each real variable into finite values and quantize the continuous interval of each variable into finite levels.Because the dimension of the model is so enormous that traditional optimization techniques cannot find its optimal solution effectively，an improved fish-swarm algorithm is used to solve the problem.In the improved algorithm，in order to delete constraints and compress greatly the variables of the model，all variables are grouped to reduce the number of variables.An evolutionary algorithm based on the neighbor competitive evolution operator is applied so that the basic properties of global and local search are mixed together and a balance between efficiency and effectiveness is realized.The multi-agent-based self-leaning and self-adaptive variation operator，the orthogonal crossover operator，the neighbor competitive evolution operator and so on are used to improve all behaviors of artificial fish-swarm algorithm.An application result shows that the speed and reliability of the algorithm has a significant improvement in the optimization algorithm，and the solution of the model can be gained in the simple computing environment.

Key words ventilation system locating of fans large-scale nonlinear mixed integer programming fish-swarm algorithm

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通讯作者 黄光球 huangnan93@sohu.com