基于双重编码遗传算法和图论的自压树状管网优化　Optimization of Gravity Tree-type Pipe Network Based on Dual Coding Genetic Algorithm and Graph Theory

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关键词：　树状管网 优化 遗传算法 双重编码 图论

摘　要：　以投资最小为目标函数，压力、流速、管径等限制为约束条件，建立了自压树状管网优化数学模型，并采用改进遗传算法进行求解。根据树状管网优化的特点，遗传算法采用二进制编码和整数编码相结合的双重编码，实现了同时对管网布置形式和管径进行优化。根据图论中树的性质，在产生初始解及变异操作时，采用基于圈的方法，对交叉方法进行了改进，从而减少了不可行解的产生。同时对遗传算法的操作过程进行了改进，结合了模拟退火算法，调整了适应函数，改进了交叉率和变异率的计算方法。算例表明了该优化方法的有效性。　An optimization model for gravity tree-type pipe network is established, in which the minimal investment is taken as the objective function, and the pressure, flow rate and pipe diameter are taken as the constraint conditions. The improved genetic algorithm is used to solve the problem. Based on the optimal features of tree-type pipe network, the dual coding combining binary coding with integer coding is adopted in the genetic algorithm to optimize the pipe layout and pipe diameter simultaneously. Based on characteristics of tree in the graph theory, the cycle method is adopted to improve cross method in the operations of initial solution creating and mutation so that the number of infeasible solutions is reduced. Some operational processes of genetic algorithm are improved. The simulated annealing algorithm is introduced in the model. The fitness function is adjusted, and the computing methods of crossover rate and mutation rate are improved. Example shows that the algorithm is efficient.

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