

轻小型移动喷灌机组低能耗遗传算法优化设计 Optimization of Light-small Movable Unit Sprinkler System Using Genetic Algorithms Based on Energy Consumption Indicators

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关键词: 喷灌机组 能耗 遗传算法 优化

摘要: 合理配置与优化设计喷灌机组有助于实现机组装置效率最大化,有效降低能量消耗。以能耗最小为目标,以水泵-管路运行工况、喷头最小工作压力和喷头压力极差率为约束条件,以喷头配置数量、管道直径和末端喷头压力为决策变量,建立轻小型移动喷灌机组优化数学模型,提出基于遗传算法的优化设计方法。在满足喷灌设计参数条件下,模型与算法能够优化喷头数量、管道直径,还能够对系统流量、压力、效率、单位能耗等工作参数进行计算与设计,同时保证水泵与管路同在优化的工况下工作,算例分析表明优化后机组的能耗降低14.2%。只需输入设计要求的已知条件,算法程序就能自行运算出优化结果,运算结果稳定可靠、求解速度快、精度高,具有良好的通用性和实用性。 Reasonable configuration and optimization design of unit sprinkler system could take the advantages as maximizing efficiency of the unit and reducing the energy consumption. An optimization model was established and genetic algorithm was used to optimize light-small movable unit sprinkler system. The objective function was minimal energy consumption, the constraint conditions were pump and pipeline operating conditions, minimum working pressure of sprinkler, percentage of sprinkler working pressure range; and the decision variables were number of sprinkler, pipe diameter, sprinkler pressure in the pipeline end, respectively. The model and algorithms could optimize the number of sprinklers, pipe diameter and calculate out the flow rate, pressure, efficiency and per energy consumption of the unit. As well as the pump and pipeline could be ensured to operate in the optimized condition and the design parameters were met. An example showed that the energy consumption was reduced by 14.2% after optimum design. The algorithms can get the optimum results automatically when known conditions were input, having the advantages of excellent efficiency, accuracy, reliability, versatility and practicability.

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