淮安-淮阴段梯级泵站群运行优化

Operation optimization of Huai'an-Huaiyin multistage pumping stations

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中文摘要：

　　为了探索大型跨流域调水工程优化运行方法，充分挖掘梯级系统优化运行效益，针对梯级泵站群优化运行数学模型，引入并联泵站群日优化运行模型和一维明渠非恒定流模型，分别采用大系统二级分解-动态规划聚合方法和追赶法求解，考虑区间用水户用水过程，进行各级并联站日均扬程优化，以淮安-淮阴梯级泵站群为例，采用淮安站群日均扬程4.15 m、80%负荷，淮阴站群日均扬程3.9 m、100%负荷，且淮阴站群推迟2 h的优化运行过程作为淮安-淮阴梯级泵站群优化运行方案。该方案下淮安站群、淮阴站群单位提水费用分别为79.33元/万m3、84.60元/万m3，较各站群定角恒速运行单位提水费用分别节省25.06%、7.3%，初步获得了梯级泵站群优化运行方案。该研究可为跨流域梯级调水系统优化调度特别是级间输水系统水位优化提供参考。

英文摘要：

　　Abstract: In order to explore the optimal operation method of large-scale inter-basin water transfer projects, and fully excavate optimal operation benefit of multistage system, the two-stage decomposition-dynamic programming aggregation method was introduced to solve the mathematical model of daily optimal operation for parallel pumping stations, by which a series of optimal operation schemes under different average daily lifts and water pumping quantities were obtained. Considering different types of water consumption along the transferring canal between two-stage pumping stations, by means of taking different start up time of pumping stations in the second stage, the obtained optimal operation schemes of pumping stations were adopted as boundary conditions and then substituted into mathematical model of one-dimensional unsteady flow to carry out the numerical simulation of water transferring canal, by which the changing process of water level in water transferring canal was simulated. According to the multiple schemes comparison and selection, the effective connection of water level between two-stage pumping stations was obtained and the optimal operation method of multistage pumping stations was preliminary proposed. Taking the two-stage pumping stations from Huai'an parallel pumping stations to Huaiyin parallel pumping stations as a study case, the optimal operation scheme of the entire multistage pumping stations system was obtained as follows: taking 4.15 m as the average daily lift and 80% loads as water pumping quantity for Huai'an parallel pumping stations, and taking 3.9 m as the average daily lift and 100% loads as water pumping quantity for Huaiyin parallel pumping stations, the start-up time of Huaiyin stations was 2 hours later than Huai'an stations. Under the optimization scheme above, the unit cost of water pumping for Huai'an parallel pumping stations and Huaiyin parallel pumping stations was 79.33 and 84.60 Yuan/104 m3 respectively, which had a respectively cost saving percentage of 25.06% and 7.3% compared with operation with fixed blade-angle and constant speed under the same average daily lift and water pumping quantities of each parallel pumping stations. The research can provide a reference for optimal operation of inter-basin water transfer system, especially for water level optimization of water transferring canals.

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