

網流最佳化模式於水庫供水網路調配 之應用

Network Flow Optimization Model Application in Reservoir Network Water Distribution

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摘 要

在傳統水庫配水模式當中，會採用網流模式來模擬不同水庫之間的串接配水。但是傳統的網流模式無法反應水庫的蓄水功能，而且在最佳化模擬時，必須要設定每個供水時間點的供水決策變數，同時各個時間點每個水庫的蓄水量必須與水庫的出流量及入流量保持流量平衡。當水庫的數量增加或者要調配的時間延長時，會導致大量的決策變數以及限制條件產生，影響模式的運算效率。本研究將利用時間序列作為模式的輸入及輸出變數，同時利用傅立葉級數將時間序列函數從時間域轉換至轉換至頻率域，將決策變數從各時間點的放流量轉變成各個頻率基底函數的係數。除了可以有效減少決策變數外，也可以讓放流時間序列以及需水時間序列的變化型態趨於一致，可以適用於長期規劃配水及不同型態水文情境的配水模擬。

關鍵詞：網流模式、最佳化、水庫網路

Abstract

The network flow model is utilized in the simulation of water distribution among reservoirs. However, the original network flow model could not mock the storage function of the reservoirs. Besides, it is an outflow decision variable for each point in time not to be set, and the mass balance of each reservoir between inflow and outflow needs to be satisfied. When the number of reservoirs is increased or the water distribution period is extended, the number of decision variables and constraints will increase quite fast to reduce the efficiency of model performance. This research would use time series as the input and output of the model and utilize the Fourier series to transform the time series function from the time domain to the frequency domain. Moreover, the decision variables are transitioned from the flow volume to the coefficients of frequency basis functions. Not only could the decision variables be reduced, but also the variation patterns of the outflow time series and the demand time series could be aligned. This model could be adapted into a long-term water distribution program and the simulation of water distribution under different hydrological scenarios.

Keywords: network flow model, optimization, reservoir network