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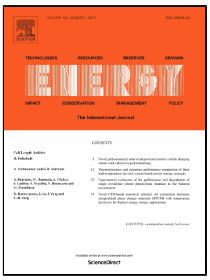

Optimization of hydropower system operation by uniform dynamic programming

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Optimization of hydropower system operation by uniform dynamic programming

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Abstract: As a popular optimization tool for multi-stage sequential decision problems, dynamic programming (DP) has been widely used to handle with hydropower system operation problems. However, the DP computational burden shows an exponential growth with the increasing number of hydroplants, which results in "the curse of dimensionality" and limits its application to resolve large and complex hydropower operation problem. Thus, this paper presents a novel modified DP algorithm called uniform dynamic programming (UDP) to alleviate the dimensionality problem of dynamic programming. In UDP, the uniform design is first used to construct the state variables set of each period by selecting some small but representative discrete state combinations, and then the DP recursive equation is used to find an improved solution for the next computation cycle. The UDP method is tested in the Wu River cascaded hydropower system of southwest China. The results indicate that the proposed UDP algorithm has competitive performance in computational efficiency and convergence speed, which is an effective tool for hydropower operation problem.

Author keywords: Multireservoir system operation; Dynamic programming; Uniform design; Dimensionality reduction; Curse of dimensionality

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