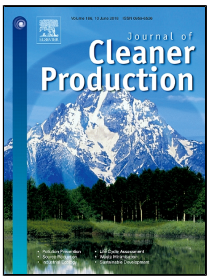
Accepted Manuscript



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PII:	S0959-6526(18)31161-2
DOI:	10.1016/j.jclepro.2018.04.134
Reference:	JCLP 12715
To appear in:	*Journal of Cleaner Production*
Received Date:	09 December 2017
Revised Date:	29 March 2018
Accepted Date:	15 April 2018

Please cite this article as: Zhong-kai Feng, Wen-jing Niu, Chun-tian Cheng, Optimizing electrical power production of hydropower system by uniform progressive optimality algorithm based on two-stage search mechanism and uniform design, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.04.134

Optimizing electrical power production of hydropower system by uniform progressive optimality algorithm based on two-stage search mechanism and uniform design

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Abstract: As one of the important renewable energy, hydropower is experiencing a booming development period throughout the world in recent years. By the end of 2016, hydropower has occupied 20.1% installed capacity and 19.5% generation in China. Thus, it is of great importance to develop some effective methods to guarantee the overall generation benefit of hydropower system. As a famous optimization tool to solve this problem, the progressive optimality algorithm cannot effectively handle with large-scale hydropower system because its computational burden grows exponentially with the increasing number of hydroplants. Thus, in order to effectively alleviate the dimensionality problem, a novel method called uniform progressive optimality algorithm is introduced here. In the presented method, the complex multistage problem is firstly divided into several two-stage optimization subproblems, and then the uniform design is adopted to sample a small subset from all the possible state vectors at each subproblem, while the successive approximation strategy is adopted to gradually improve the quality of solution. The results from a real-world hydropower system of China indicate that compared with progressive optimality algorithm, the proposed method has superior performance in execution efficiency and convergence speed, which is an effective alternative method for the complex hydropower system operation problem.

Keywords: Hydropower system operation; Progressive optimality algorithm; Dimensionality reduction; Curse of dimensionality; Uniform design; Successive approximation