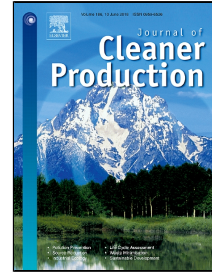


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Optimizing electrical power production of hydropower system by uniform progressive optimality algorithm based on two-stage search mechanism and uniform design



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1 **Optimizing electrical power production of hydropower system by** 2 **uniform progressive optimality algorithm based on two-stage search** 3 **mechanism and uniform design**

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

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

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