Water Resour Manage (2008) 22:1709–1722
DOI 10.1007/s11269-008-9249-5

Design-Operation of Multi-Hydropower Reservoirs: HBMO Approach

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Received: 21 January 2007 / Accepted: 10 January 2008 /
Published online: 19 February 2008

Abstract To illustrate and test the applicability and performance of the innovative honey-bee mating optimization (HBMO) algorithm in highly non-convex hydropower system design and operation, two problems are considered: single reservoir and multi-reservoir. Both hydropower problems are formulated to minimize the total present net cost of the system, while achieving the maximum possible ratio for generated power to installed capacity. The single hydropower reservoir problem is approached by the developed algorithm in 10 different runs. The first feasible solution was generated initially and later improved significantly and solutions converged to a near optimal solution very rapidly. In the application of the proposed algorithm to a five-reservoir hydropower system with 48 periods and a total of 230 decision variables, in early mating flights, the first feasible solution was identified and the results converged to a near optimal solution in later mating flights. In the case of the multi-reservoir problem, an efficient gradient-based nonlinear-programming solver (LINGO 8.0) failed to find a feasible solution and for the single hydropower reservoir design problem it performed much worse than the proposed algorithm.

Keywords Honey-bee mating optimization · Design-operation · Multiple hydropower reservoirs · Non-convex

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