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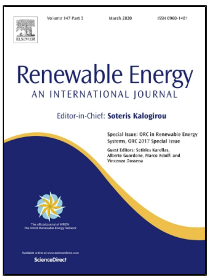

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Simulation – Optimization Models for Multi-Reservoir Hydropower Systems Design at Watershed Scale

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Abstract

Hydropower energy is one of the most economical and cleanest energies in the world. Due to the huge investment in hydropower projects, economic feasibility and determining the main design parameters related to plant sizing of hydro projects are extremely important. In this research, a simulation–optimization model for optimal design of hydropower systems with a systematic view of the basin (which is a complex nonlinear problem) has been developed. For water resources planning and management in the water basin, WEAP model has been used. Despite various capabilities, there are also limitations for hydropower systems modeling in WEAP. In this regard, a hydropower computation module has been employed to resolve these disadvantages. Then, PSO algorithm, linked to the simulation model and the developed optimization-simulation model has been used to solve the problem of optimal design of Garsha, Kuran Buzan, Sazbon and Tange mashoore power plant projects in Karkhe river basin. Objective function has been formulated based on two conventional methods in the economic analysis of hydro projects, i.e. electricity market price method and alternative thermal plant method. The objective function is maximization of net benefits of hydropower projects considering all resources, uses, and demands in the basin. Normal water level (NWL), Minimum Operation Level (MOL), Installed Capacity (IC) of dams and power-plants were chosen as decision variables of the problem.