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Hidro-IA: An Artificial Intelligent Tool Applied to Optimize the Operation Planning of Hydrothermal Systems with Historical Streamflow

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Abstract : The area of the electricity sector that deals with energy needs by the hydroelectric in a coordinated manner is called Operation Planning of Hydrothermal Power Systems (OPHPS). The purpose of this is to find a political operative to provide electrical power to the system in a given period, with reliability and minimal cost. Therefore, it is necessary to determine an optimal schedule of generation for each hydroelectric, each range, so that the system meets the demand reliably, avoiding rationing in years of severe drought, and that minimizes the expected cost of operation during the planning, defining an appropriate strategy for thermal complementation. Several optimization algorithms specifically applied to this problem have been developed and are used. Although providing solutions to various problems encountered, these algorithms have some weaknesses, difficulties in convergence, simplification of the original formulation of the problem, or owing to the complexity of the objective function. An alternative to these challenges is the development of techniques for simulation optimization and more sophisticated and reliable, it can assist the planning of the operation. Thus, this paper presents the development of a computational tool, namely Hydro-IA for solving optimization problem identified and to provide the User an easy handling. Adopted as intelligent optimization technique is Genetic Algorithm (GA) and programming language is Java. First made the modeling of the chromosomes, then implemented the function assessment of the problem and the operators involved, and finally the drafting of the graphical interfaces for access to the User. The results with the Genetic Algorithms were compared with the optimization technique nonlinear programming (NLP). Tests were conducted with seven hydroelectric plants interconnected hydraulically with historical stream flow from 1953 to 1955. The results of comparison between the GA and NLP techniques shows that the cost of operating the GA becomes increasingly smaller than the NLP when the number of hydroelectric plants interconnected increases. The program has managed to relate a coherent performance in problem resolution without the need for simplification of the calculations together with the ease of manipulating the parameters of simulation and visualization of output results.

Keywords : energy, optimization, hydrothermal power systems, artificial intelligence and genetic algorithms
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