Heuristic search and mathematical programming in design of water distribution networks

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The problems involved in the optimal design of water distribution networks belong to a class of large combinatorial optimization problems. Various heuristic and deterministic algorithms have been developed in the last two decades for solving optimization problems and applied to the design of water distribution systems. Nevertheless, there is still uncertainty about finding a generally reliable method. In the proposed method two algorithmic techniques are employed – linear programming (LP) and heuristic search. A combination of these two methods with the aim of eliminating the limitations of LP (which is not suitable for networks with loops) is used. It was investigated that proposed method provides results more reliable in terms of closeness to a global minimum. The main idea is that linear programming is more reliable than heuristic methods, but because it is suitable only for solving branched networks, heuristic method is used for decomposing a complex looped network into a group of branched networks. A new approach for solving the optimal design problem of water distribution systems, taking advantage of the LP formulation for receiving split pipe solutions, and the heuristic robustness, will be formulated and demonstrated on the benchmark and real life networks.