



## Multi-objective optimization of water distribution networks using particle swarm optimization

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### ABSTRACT

Most applied optimization problems involve several objectives, which must be solved simultaneously within a set of constraints. When conflicting objectives exist, there is no single solution to be chosen as the best one, but a set of optimal solutions to the problem. When the decision variables are discrete, the complexity of the problem increases even further. In the present work, a multi-objective model is presented to solve the problem of water distribution network optimization with discrete variables. The problem has a mixed discrete nonlinear programming formulation. A new algorithm based on particle swarm optimization is proposed in order to solve the model. Hydraulic simulator EPANET v2.1 is used to calculate the pressure at each node and flow velocity of water in each pipe. Two problems from the literature are studied, having as objectives the minimization of pipeline installation costs and the minimization of pumping energy costs for the system. Through the weighted sum method, the problems of WDN were solved. The proposed algorithm is verified to be efficient, with equal or better results than those found in the literature.

**Keywords:** Mixed discrete nonlinear programming; Multi-objective optimization; Water distribution networks; Particle swarm optimization; EPANET

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