The efficiency of setting parameters in a modified shuffled frog leaping algorithm applied to optimizing water distribution networks

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This paper presents a modified Shuffled Frog Leaping Algorithm (SFLA) applied to thedesign of water distribution networks. Generally, one of the major disadvantages of the traditionalSFLA is the high number of parameters that need to be calibrated for proper operation of thealgorithm. A method for calibrating these parameters is presented and applied to the design ofthree benchmark medium-sized networks widely known in the literature (Hanoi, New York Tunnel, and GoYang). For each of the problems, over 35,000 simulations were conducted. Then, a statisticalanalysis was performed, and the relative importance of each of the parameters was analyzed toachieve the best possible configuration of the modified SFLA. The main conclusion from this studyis that not all of the original SFL algorithm parameters are important. Thus, the fraction of frogs inthe memeplex q can be eliminated, while the other parameters (number of evolutionary steps Ns, number of memeplexes m, and number of frogs n) may be set to constant values that run optimallyfor all medium-sized networks. Furthermore, the modified acceleration parameter C becomes the keyparameter in the calibration process, vastly improving the results provided by the original SFLA.

Design

Optimization

Shuffled frog leaping algorithm

Water distribution networks

Algorithms

Calibration

Design

Optimization

Water distribution systems

Water supply systems

Acceleration parameters

Algorithm parameters

Calibration process

Constant values

Modified shuffled frog leaping algorithms

Setting parameters

Shuffled frog leaping algorithm (SFLA)

Water distribution networks

Parameter estimation

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