Geophysical Research Abstracts
Vol. 19, EGU2017-6985, 2017
EGU General Assembly 2017

New methods versus the smart application of existing tools in the design of water distribution network

Milan Cisty, Zbynek Bajtek, Lubomir Celar, and Veronika Soldanova

Slovak University of Technology Bratislava, Department of Land and Water Resources Management, Bratislava, Slovakia (milan.cisty@stuba.sk)

Finding effective ways to build irrigation systems which meet irrigation demands and also achieve positive environmental and economic outcomes requires, among other activities, the development of new modelling tools. Due to the high costs associated with the necessary material and the installation of an irrigation water distribution system (WDS), it is essential to optimize the design of the WDS, while the hydraulic requirements (e.g., the required pressure on irrigation machines) of the network are gratified.
In this work an optimal design of a water distribution network is proposed for large irrigation networks. In the present work, a multi-step optimization approach is proposed in such a way that the optimization is accomplished in two phases. In the first phase suboptimal solutions are searched for; in the second phase, the optimization problem is solved with a reduced search space based on these solutions, which significantly supports the finding of an optimal solution.
The first phase of the optimization consists of several runs of the NSGA-II, which is applied in this phase by varying its parameters for every run, i.e. changing the population size, the number of generations, and the crossover and mutation parameters. This is done with the aim of obtaining different sub-optimal solutions which have a relatively low cost.
These sub-optimal solutions are subsequently used in the second phase of the proposed methodology, in which the final optimization run is built on sub-optimal solutions from the previous phase. The purpose of the second phase is to improve the results of the first phase by searching through the reduced search space. The reduction is based on the minimum and maximum diameters for each pipe from all the networks from the first stage. In this phase, NSGA-II do not consider diameters which are outside of this range. After the NSGA-II second phase computations, the best result published so far for the Balerma benchmark network which was used for methodology testing was achieved in the presented work.
The knowledge gained from these computational experiments lies not in offering a new advanced heuristic or hybrid optimization methods of a water distribution network, but in the fact that it is possible to obtain very good results with simple, known methods if they are properly used methodologically.

ACKNOWLEDGEMENT
This work was supported by the Slovak Research and Development Agency under Contract No. APVV-15-0489 and by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences, Grant No. 1/0665/15.