Geophysical Research Abstracts
Vol. 12, EGU2010-10938, 2010
EGU General Assembly 2010


# Effectiveness evaluation of heuristic algorithms applied in hybrid models for water distribution networks design

Milan Cisty and Zbynek Bajtek

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

This work is focused on evaluation and effectiveness comparison of two different heuristic algorithms in context of hybrid model used for optimization of the pressurized water distribution systems: genetic algorithm (GA) and harmony search methodology (HS). The optimization of the water distribution system is a complex problem which involves determining the commercial diameter for each pipe in the network while satisfying the water demand and pressure at each node (least-cost design task). The optimal design is in this formulation of the problem the lowest cost design out of numerous possibilities. Hybrid models present a further step in this optimization task, by elimination of some disadvantages in its standard formulation where are heuristic methods applied usually alone (extensive fine-tuning, very big search space, no guarantee for global optimum especially in big problems, etc). In the proposed and described hybrid method two substantially different algorithmic techniques are employed – linear programming (LP) and heuristic algorithm (genetic algorithms or harmony search in this work). Authors put together the contribution each of these algorithms to common task in which best possibilities of each other are employed and disadvantages are eliminated (LP is not suitable for looped networks and heuristic methods do not guarantee global optimum). The GA or HS method is used in the outer loop of the proposed algorithm, which is intended for decomposing a complex looped network to a group of possible branched networks. The mathematical models using LP are then automatically set up in an inner loop for each selected (by GA or HS) member of this group of branched networks for their optimization. After evaluating the high number of possible branch networks (by LP which is nested in a GA or HS objective function), an optimal solution could be found for the original looped network. The advantage of using this hybrid method consists in the fact that GA or HS in this case has a much smaller searching space than in a case when these heuristic methodologies are used alone. Models were tested on the benchmark networks with focusing on evaluation of the influence of heuristic algorithms on the obtained results, e.g. which from these two heuristic methods applied in hybrid models offer results closer to the global optimum. The performance of particular hybrid combination is evaluated by an application for the optimization of the Hanoi network and for the triple Hanoi water supply network. The first problem is taken from the literature. The second is introduced by the authors for the sake of evaluating the proposed method also on a bigger problem than the known and thoroughly investigated benchmark models are. It was investigated that both the method give results more reliable in the terms of closeness to a global minimum than any tested heuristic alone and hybrid alternative with harmony search methodology surpassed hybrid alternative with GA as its heuristic part.
This work was supported by the Slovak Research and Development Agency under the contract No. LPP - 0319-09.