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"Gheorghe Asachi" Technical University of Iasi, Romania

ANT INTELLIGENT APPLIED TO SEWER NETWORK DESIGN OPTIMIZATION PROBLEM: USING FOUR DIFFERENT ALGORITHMS

Ramtin Moeini

Department of Civil Engineering, University of Isfahan, Postal Code: 81746-73441, Isfahan, Iran
E-mail: r.moeini@eng.ui.ac.ir; Phone: +9831 37935628; Fax: +9831 37932089

Abstract

In this paper, four different kinds of the Ant Colony Optimization Algorithm (ACOA) are used to find optimal solution for sewer network design optimization problem proposing two different formulations for each of them. In both proposed formulations, the decision variables of the problem are cover depths of sewer network nodes. In the second formulation, the constrained version of ACOA is used to find optimal cover depths of the sewer network nodes. The constrained version of ACOA is used here to satisfy slope constraints explicitly leading to reduction of search space of the problem. The Ant System, Elitist Ant System, Elitist-Rank Ant System and Max-Min Ant System are used here to solve two benchmark test examples and the results are presented and compared with other available results. The results show the superiority of the Max-Min Ant System over than other ACOAs in which the trade off between the two contradictory search characteristic of exploration and exploitation is managed better using this algorithm. Furthermore, best results are obtained with second proposed formulation in comparison with other available results in which they are shown the capability of the proposed formulation to find optimal solution for sewer network design optimization. In other words, the second formulation of Max-Min Ant System has been able to produce results 0.3% and 0.15% cheaper than those obtained by first formulation of Max-Min Ant System for the first and second benchmark test examples, respectively. Furthermore, the average solution cost value of second formulation of Max-Min Ant System is reduced 10.6% (8.1%), 0.43% (0.6%) and 0.34% (0.02%) in comparison with second formulation of Ant System, Elitist Ant System and Elitist-Rank Ant System for first (second) benchmark test examples, respectively.

Key words: Ant Colony Optimization Algorithm, constraint, optimal design, sewer network

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