Abstract

Genetic Algorithm Optimization (GAO) approach for water systems with multiple pollutants and several Low-Level Contaminated Water (LLCW) resources is presented. This approach generates the Optimal Water Network Topology (OWNT) with a minimum LLCW usage, (considering only one resource at the time) and complying with all restrictions. An OWNT could be viewed as an oriented graph, starting from unit operations with the lowest level of contaminants at entrance, the ordering rule being either the load or the maximum LLCW consumption. The mathematical model is based upon total and contaminant species mass balances, together with the input and output units’ constraints. The GAO uses each internal flow as a gene, defining a chromosome from all these flows, to overcome the fact that the unknowns’ number outcomes the equations’ number. The individuals are interbreed according to their frequency of selection, using one-point crossover method, and then mutation is applied to randomly selected members of the new population. The objective function is to minimize the total LLCW consumption. Comparison with the results of mathematical programming methods is made.

Keywords: genetic algorithms, low-level contaminated water resources minimization, multiple contaminants, water system integration