Optimal multi-year management of a water supply system under uncertainty: affine adjustable robust counterpart approach

Mashor Housh\textsuperscript{1}, Avi Ostfeld\textsuperscript{2} and Uri Shamir\textsuperscript{3}

\textsuperscript{1}PhD Student; \textsuperscript{2}Associate Professor; \textsuperscript{3}Professor Emeritus, Faculty of Civil and Environmental Engineering, Technion, Haifa, Israel

The recently developed Robust Optimization (RO) methodology (Ben-Tal et al., 2009) is applied for optimal dynamic multi-year management of a water supply system. The system is comprised of a water supply system fed from natural sources (aquifers) which depend on uncertain recharge and developed sources (desalination) with fixed capacity are addressed. The water is transported to consumers through the network to meet water demands and salinities. The objective is to decide dynamically on the optimal operating policy based on the revealed uncertainty for minimizing the total operation cost of the system and for fulfilling operational constraints over multiple time decision points. The RO methodology uses a min-max approach to solve the problem, assuming that the uncertain parameter can only reside within a user-defined uncertainty set. The dynamic version of RO is called the Adjustable Robust Counterpart (ARC). One of its special tractable versions is the Affine Adjustable Robust Counterpart (AARC) in which the dependence of the future decision variables on revealed data is restricted to be linear. In this work the AARC is applied to solve the above problem. The solution is then further compared to the static version of the RO (i.e., the Robust Counterpart). Moreover, a less restrictive version of the AARC which combines the min-max and the nominal approach is presented and discussed.