FUZZY WASTE LOAD ALLOCATION MODEL FOR WATER QUALITY MANAGEMENT OF A RIVER SYSTEM, SIMULATION-OPTIMIZATION

Abstract: A fuzzy waste load allocation model is developed for the water quality management of a river systems by using fuzzy multiple objective optimization. The model addresses the uncertainty in a water quality system in a fuzzy probability framework. The goals related to pollution control agency (PCA) and dischargers are expressed as fuzzy sets. The membership functions of these of these fuzzy sets are considered to represent the variation of satisfaction levels of the PCA and dischargers. In this model two formulations are proposed. The MAX-MIN formulation maximizes the minimum satisfaction level of the PCA. The MAX-BIAS formulation maximizes a bias measure giving a solution that favors the dischargers. Unlike such all water quality management models the usage of cost curves is eliminated because these curves are uncertain and non linear. A genetic algorithm (GA) is used as an optimization tool to find the fractional removal levels to the dischargers and the corresponding satisfaction level. Because a GA is an unconstrained optimization tool, it is extended to handle constraints by complementing it with homomorphous mapping (HM), a constraint handling method for evolutionary algorithms. The GA directs the decision vector in an encoded form to HM. HM, after a few interactions with QUAL2E, redirects the decoded solution back to the GA. The GA assigns a fitness value to the feasible solution vector and applies operators to refine the solution. This interaction among the GA, HM, and QUAL2E continues until a pre specified criterion for global optimality is met. Application of the model is illustrated with the case study of the Tunga-Bhadra River in south India.