Application of Finite Volume Method for Numerical Simulation of Contaminant Transfer in a Two-Dimensional Reservoir

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Abstract : Today, due to the growing urban population and consequently, the increasing water demand in cities, the amount of contaminants entering the water resources is increasing. This can impose harmful effects on the quality of the downstream water. Therefore, predicting the concentration of discharged pollutants at different times and distances of the interested area is of high importance in order to carry out preventative and controlling measures, as well as to avoid consuming the contaminated water. In this paper, the concentration distribution of an injected conservative pollutant in a square reservoir containing four symmetric blocks and three sources using Finite Volume Method (FVM) is simulated. For this purpose, after estimating the flow velocity, classical Advection-Diffusion Equation (ADE) has been discretized over the studying domain by Backward Time- Backward Space (BTBS) scheme. Then, the discretized equations for each node have been derived according to the initial condition, boundary conditions and point contaminant sources. Finally, taking into account the appropriate time step and space step, a computational code was set up in MATLAB. Contaminant concentration was then obtained at different times and distances. Simulation results show how using BTBS differentiating scheme and FVM as a numerical method for solving the partial differential equation of transport is an appropriate approach in the case of two-dimensional contaminant transfer in an advective-diffusive flow.

Keywords : BTBS differentiating scheme, contaminant concentration, finite volume, mass transfer, water pollution
Conference Title : ICAWPCE 2018 : International Conference on Advances in Water Pollution Control Engineering
Conference Location : Dublin, Ireland
Conference Dates : November 19-20, 2018