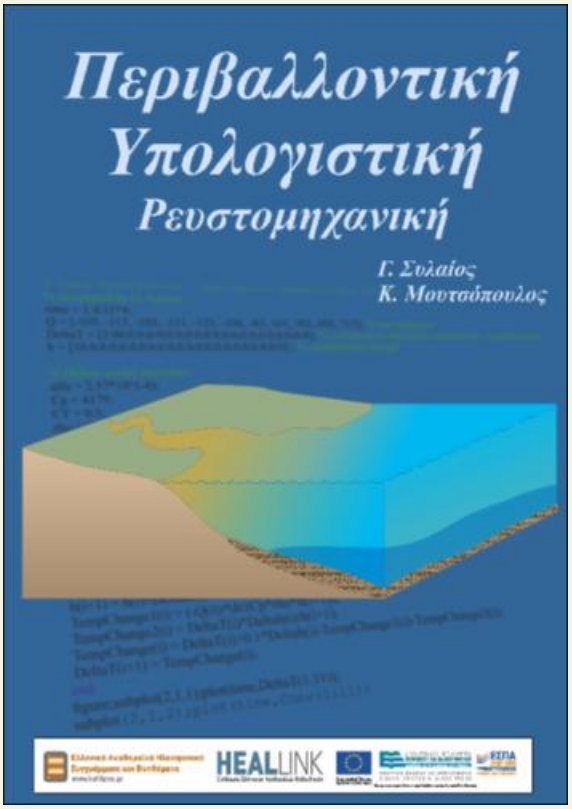

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Abstract

This textbook consists of two parts. The first part deals with the teaching of the main theoretical equations of environmental fluid mechanics. It thoroughly analyzes the main mathematical equations used to simulate environmental flows (Navier-Stokes continuity equation, depth-integrated continuity equation, laterally integrated continuity and motion equations, pollutant transport and diffusion equation, subsurface flow equations), while the empirical equations for estimating the turbulent viscosity and turbulent diffusion coefficients are determined. The methodology for solving the above equations using the finite difference and control volume techniques is analyzed, and a series of exercises and problems are presented. The second part presents applied environmental flows and the processes of pollutant transport and diffusion in them. In particular, the processes and simulation of pollutant transport and diffusion phenomena in one-dimensional flows (e.g. channels, streams, rivers), two-dimensional flows (lakes, reservoirs, river mouths, coastal systems) and three-dimensional flows (open sea). In addition, the textbook deals with the study of the behavior of submarine veins and plumes that develop in the coastal zone, and deals with the optimal design of such projects in order to achieve the reduction of environmental impacts. Finally, examples of simulation and management of groundwater resources are presented. The methodology for discretizing the computational domain, the process of simplifying three-dimensional theoretical equations through assumptions, the application of initial and boundary conditions, and the possibility of interconnecting the model with other models of broader flow are examined. Each chapter presents applications developed by the authors and applied to existing water systems.

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