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2.3.5 The characteristics curves; 2.3.6 Notions on hydraulic jumps; 2.3.7 Saint-Venant equations in Mercator projection; 2.3.8 Saint-Venant equations with porosity; 2.3.9 Boussinesq equations; 2.3.10 Serre equations
2.3.11 Source terms and body forces in two dimensions2.3.12 Boundary conditions in 2D; 2.3.13 Tracer equation in two dimensions; 2.4 Modelling of turbulence and dispersion; 2.4.1 Reynolds stress; 2.4.2 Zero-equation models; 2.4.3 Turbulence stress on the walls; 2.4.4 Equations of the k-e model; 2.4.5 Other models; 3 Principles of the finite element method; 3.1 Introduction; 3.2 Interpolation in finite elements; 3.3 Variational principle; 4 Resolution of the Saint-Venant equations; 4.1 A glance at the existing methods; 4.1.1 Main properties of a (good) numerical scheme
4.1.2 Finite difference schemes4.1.3 Finite volume schemes for hyperbolic equations; 4.1.4 Kinetic schemes; 4.1.5 Finite element schemes; 4.2 Overall view of the Telemac-2D algorithm; 4.3 Fractional steps method; 4.4 Advection stage using the method of characteristics; 4.5 Propagation, diffusion, source terms; 4.5.1 Time discretization; 4.5.2 Space discretization; 4.5.3 Variational formulation; 4.5.4 Natural boundary conditions; 4.5.5 Sources and sinks; 4.5.6 Matrix form of the system; 4.6 Radiation conditions; 4.7 Resolution of the Boussinesq equations
4.8 Resolution of k-e model equations in 2D4.8.1 Advection step; 4.8.2 Production, diffusion, source terms; 4.9 Solving the tracer equation in 2D; 4.10 Laws of conservation in 2D; 4.10.1 Mass conservation of the fluid; 4.10.2 Conservation of the tracer; 4.10.3 Head and momentum conservation; 4.10.4 Conservation of energy; 4.11 The treatment of uncovered beds; 4.11.1 Option 1: correction of the free surface gradient; 4.11.2 Option 2: masking of exposed elements; 4.12 Pseudo wave equation; 4.13 Some validation test cases; 4.13.1 Test of a lake at rest
4.13.2 Rapid flow over a weir with a hydraulic jump downstream

Sommario/riassunto

A definitive guide for accurate state-of-the-art modelling of free surface flows Understanding the dynamics of free surface flows is the starting point of many environmental studies, impact studies, and waterworks design. Typical applications, once the flows are known, are water quality, dam impact and safety, pollutant control, and sediment transport. These studies used to be done in the past with scale models, but these are now being replaced by numerical simulation performed by software suites called "hydro-informatic systems". The Telemac system is the leading software package wor

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