文岑,张永祥,陈景秋,曾忠.用CE/SE法对弯曲与分叉河道的溃坝洪水波的数值研究[J].计算力学学报,2010,27(3):435~441

用CE/SE法对弯曲与分叉河道的溃坝洪水波的数值研究

Numerical simulation of dam-break flows in curved and furcated channels by using space-time Conservation Element and Solution Element method

投稿时间： 2008-09-09

DOI：10.7511/jslx20103009

中文关键词： 溃坝洪水波 时空守恒元和解元方法(CE/SE法) 浅水方程 弯曲河道 分叉河道

英文关键词:dam-break CE/SE method shallow water equations bend channel furcated channel

基金项目:国家自然科学基金(10872222);教育部博士点基金(20070611004)资助项目.

作者	单位
文岑	重庆大学 资源与环境科学学院,重庆 400044;重庆交通大学 西南水运工程科学研究所,重庆 400074
张永祥	重庆大学 资源与环境科学学院,重庆 400044
陈景秋	重庆大学 资源与环境科学学院,重庆 400044
曾忠	重庆大学 资源与环境科学学院,重庆 400044

中文摘要:

对作者的二维溃坝洪水波的数学模型进一步推广,得到了一般形式的基于任意四边形网格的时空守恒元和解元方法(简称CE/SE法)的新的格式。CE/SE法从守恒积分型浅水方程出发,设立守恒元和解元,严格保证其物理意义上的守恒律,并且构造思想简单,格式通用性好。首先采用CE/SE法计算等宽矩形河道的溃坝洪水波,并与Stoker解析解进行比较,在此基础上,数值模拟了180度强弯曲河道、45度三支分叉河道的二维溃坝洪水波的演进过程,揭示了溃坝洪水波在弯曲河道中内外两岸速度与水位的变化,在分叉河道中自动进行流量与动量的再分

英文摘要:

In this paper, the 2D dam-break numerical model is extended to obtain a general form of space-time Conservation Element and Solution Element (for short: CE/SE) scheme for 2D shallow water equations over arbitrary quadrilateral cells. Space and time are unified and treated on the same footing, and by the introduction of conservation element and solution element, both local and global flux conservations in space and time instead of in space only are enforced, it is simpler and easier to apply. Firstly, the CE/SE solution and Stoker's analytical solution is compared in rectangular, frictionless, horizontal channel. Next, the dam-break flows are simulated by using the new CE/SE scheme for the cases in channel with a 180 degree strong bend and a 45 degree three branches. The complex characteristics of velocity and water elevation change at both banks of the curved sections, auto-reassignment of discharges and momentum as well as the vortices and super-elevation near the corner of embranchment regions in the furcated channels are displayed. It shows many advantages of the new CE/SE scheme such as its stability, high efficiency, high accuracy and high resolution of shock. This new scheme is flexible and can be used in the computation of many flow problems. It is proved that the CE/SE method is a new and high accuracy numerical method for studying dam-break flood wave.

查看全文 查看/发表评论 下载PDF阅读器

关闭