2D Shallow Water Equations by Localized Meshless Methods

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Abstract:

In this paper, localized meshless numerical methods using radial basis function differential quadric (LRBFDQ) method is applied to solve two dimensional shallow water equations. Generally speaking, meshless (meshfree) methods can be easily applied to problems with complex boundary shapes. The LRBFDQ method, a newly developed meshless method, has been found to have high engineering applicability, because its weighting coefficients can be determined by different radial basis functions (RBFs) depending on the interested problems. With different characteristics, the adopted RBFs can be chosen from several types such as multi-quadric (MQ), integral MQ, Gaussian, polyharmonic spline, or integral polyharmonic spline. For the numerical experiments, the 2D dam break problem has been solved first, then some applications in real project such as the Taiwan river system will be shown in the text. The analyses of the numerical results by different RBFs will be discussed in details and then compared with analytical and other numerical solutions in the literature. By this study, the performance of this meshless numerical method is demonstrated, and the most appropriate RBFs for 2D shallow water equations is obtained.

Keywords: RBF, LRBFDQ, Shallow Water Equations, Meshless, 2D, MQ, Gaussian, polyharmonic spline.