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STABILIZED FINITE ELEMENT METHOD FOR FLOOD FLOW SIMULATION IN URBAN AREA

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ABSTRACT

A number of natural disasters occur annually in various parts of the world. Especially, a number of flood disasters in cities increases in accordance with the development of city area, such as flood, storm surge, Tsunami waves and so on. In order to estimate the extent of a disaster quantitatively, it is necessary to estimate the behavior of natural phenomena which causes the natural disaster.

These flood disasters can be described by the shallow water equations, which can be obtained from the conservation of momentum and mass, vertically integrated, assuming a hydrostatic pressure distribution. There have been presented a number of numerical methods based on the finite element method, since the finite element method is applicable to complicated water and land configurations and is able to represent such configurations accurately. The present authors have been presented a finite element method based on the Streamline-Upwind/Petrov-Galerkin (SUPG) formulation for shallow water flows [1, 2]. Typically the SUPG formulation is used in combination with a shock-capturing term [3] that provides additional stability near the shock front.

This paper presents a stabilized finite element method based on the SUPG formulation for shallow water flows considering the moving boundaries. A new shock-capturing parameter for shallow water flows is presented in this paper. In order to evaluate the human damage, the evacuation analysis based on multi-agent model is employed. The present method is applied to the several numerical examples to show the validity of the method.

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