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CIVA-Stabilized Finite Element Method for Tsunami Simulations

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This paper presents a numerical method using the CIVA-stabilized finite element method based on SUPG (CIVA-SUPG) for tsunami simulations. The Boussinesq equation is employed for the governing equation in order to treat both the wave nonlinearity and dispersion effects. The equation is divided into two phases, an advection phase and a non-advection phase. The CIVA method is employed to the equation for the advection phase and the stabilized finite element method based on SUPG is employed to the equation for non-advection phase. The Eulerian approach using fixed grid is employed for the moving boundary technique for describing tsunami run-up. The present method is applied to several benchmark examples to show the validity and efficiency of the method. For the application example, the present method is employed to the tsunami simulation generated by Great East-Japan earthquake using an unstructured triangular grid with the element Courant number constant.

Keywords: CIVA-SUPG Finite Element Method, Tsunami, Boussinesq Equation, Wave Run-up