

Evaluation of Collision of a Floating Object based on Bayesian Statistics and Simulation using Particle Method

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ABSTRACT

Moving Particle Semi-implicit (MPS) method has been developed for fluid flows with free surfaces. One of the applications is tsunami run-up on coastal area[1]. Flooding in a building with complex shapes was also analyzed by the MPS method[2]. Many debris are accompanied with tsunami, such as wood, concrete, and even cars, which damage the buildings. Flooding with floating objects was calculated in [3]. However, it was found that motion of the floating objects is sensitive to a damping coefficient. Small change of the parameter largely affects the behavior of the objects in the downstream. If the simulation is used to evaluate the risks of collision of the floating objects, we need to repeat the simulation many times by changing the parameter. In the present study, Bayesian statistics is employed to determine the next case of simulation. The number of simulation is expected to reduce using the present method.

In the present study, the initial position is considered as the parameter. A floating object is located at a given position in the upstream of a building as the initial condition. Three-dimensional dam collapse with the floating object is analyzed as a fluid-rigid body coupled problem. The MPS method and the PMS model are used for the fluid and the rigid body, respectively. At the beginning, 10 cases are performed and the results are regarded as value 1 or -1 for collision and non-collision to the building, respectively. The next case is determined by using Bayesian optimization. The initial position which is expected to show the largest value is then obtained.

Convergence is achieved before the all cases are completed. This means that the collision probability is gained with a smaller number of simulation.

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