How should we deal with surface properties of plunging body to calculate water splash?

Genki Yagawa[*], Masao Yokoyama[#] and Osamu Mochizuki[*]

*Toyo University
[#]Meisei University

One of the serious problems faced when we simulate the splashes by a solid body plunging into the water is how to model the properties of the wall of the solid object that touches the water. The wall is usually assumed in numerical simulations so that the water does not permeate into the object and the non-slip boundary condition is hold between the object and the water. It is well recognized that the above assumptions cannot distinguish the qualities of the surface of the steel and those of the skin of an animal in the water. In other words, the simulated result of the splash by the hydrogel object and that by the acrylic resin object becomes the same.

The importance of consideration of the surface properties in the splash formation can be seen in several experimental results, showing that the splash patterns strongly depend on the surface conditions of the solid object.

To calculate the splash, the large geometry change of the free surface of water is to be solved. Several studies were reported for splash and droplet dealing with the free surface flow by the particle methods. However, these researches ignored the difference of surface properties due to different materials, so the effects of a surface condition on the splash formation remain to be the open question.

The purpose of the present paper is to discuss the effects of the difference of the surface conditions when we solve a splash caused by a sphere diving into water with the Particle Method. Proposed here are the engineering models to describe the wall conditions, considering the effect of the slip such as the hydrophilicity and the attractive force or the electrostatic force.