

A study on Prediction of Water Discharge Performance for Showerhead Product Design

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LIXIL Co. handles a wide range of water-related products such as toilets, baths, and kitchens. The fluid behaviour control is a key technology for developing of these products. Therefore, the numerical simulation with CFD plays an important role in product and technical development.

The flow of water in a toilet has been simulated with the finite volume method (FVM). However, the simulation with a large number of fine droplets such as in a shower needs a lot of computational cost. To deal with this problem, MPS particle method[1] has been introduced to take advantages of enabling for simulating such as liquid splashing, and mixing. In this paper, the application of the simulation to the design of a showerhead is discussed.

The discussed shower has high water-saving performance. The impeller inside the showerhead rotates at high speed while half blocking the holes in the showerhead. By increasing the pressure in the blocked area, strong water flows can be released even with a small amount of water. This enables a bathing experience with a sense of water volume while maintaining high water-saving performance. The possibility with the MPS for product development was investigated for this shower, too.

The major subjects to be studied are as follows;

- (1) Prediction of impeller rotation speed and transition
- (2) Prediction of water behaviour and droplet size
- (3) Prediction of internal pressure of the showerhead

In conventional MPS particle method, the accurate prediction is difficult because an only constant rotational velocity can be applied to the impeller. To improve the accuracy, it is necessary to solve the problem by coupling the water flow and the motion of the impeller. Therefore, in this research, a coupling technique of MPS and rigid body dynamics are applied. As a result, the simulated results show a good agreement with the experimental one.

This paper focuses on the application of the MPS particle method to the showerhead design. Since computational efficiency is also an important factor for the product development, the computational performance of multi-GPU for the MPS particle method is also discussed.

REFERENCES

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