Estimation of the In-Depth Debris Status of Fukushima Unit-2 and Unit-3 with Multi-Physics Modeling
(5) Numerical Analysis of Simulant Molten Debris Spreading and Ablation on BWR Pedestal Experiments with MPS Method

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The Moving Particle Semi-implicit (MPS) method is being developed for simulation of multi-component liquid/solid relocation with solid-liquid phase changes. Main model developments and validation of the developed code against the simulated spreading and ablation experiments are summarized in the current paper.

Keywords: severe accident, MPS method, decommissioning of Fukushima reactor, numerical simulation

1. Introduction

The decommissioning of Fukushima Daiichi (1F) Nuclear Power Plants requires knowledge of the in-depth debris status within the pedestals of 1F. The Moving Particle Semi-implicit (MPS) method [1] is being developed for the simulation of multi-component liquid/solid relocation with solid-liquid phase changes.

2. MPS method and developed models

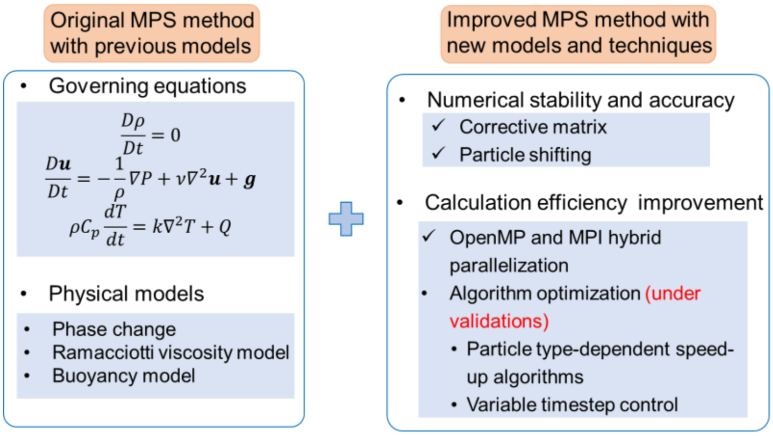

Fig. 1 MPS method and improved models

3. Validation results

Validations have been performed against the simulant molten debris spreading and ablation tests carried out at Waseda University. The capability and validity of the improved MPS code to address the multi-component system accompanied by solid-liquid phase changes have been well confirmed.

4. Future work

Additional efforts will also be given to validations of the following algorithm optimization 1) Speed-up algorithms depending on particle types and conditions 2) variable timestep control, in order to further reduce the calculation cost when extrapolations to the plant-scale are considered.

5. Acknowledgement

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References

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