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A data-driven approach to simulate turbulent bubbly flows using machine learning for modeling bubble size. HOKYO JUNG, YOUNGJAE KIM, SERIN YOON, GANGWOO HA, Dept. of Mechanical Engineering, Sogang University, JUN HO LEE, HYUNGMIN PARK, Dept. of Mechanical and Aerospace Engineering, Seoul National University, DONGJOO KIM, Dept. of Mechanical Engineering, Kumoh National Institute of Technology, JUNGWOO KIM, Dept. of Mechanical System Design Engineering, Seoul National University of Science and Technology, SEONGWON KANG, Dept. of Mechanical Engineering, Sogang University — We investigated a bubble size model using artificial neural networks (ANN). A multi-layer ANN is employed as a basis to remove a need for assuming the functional form. From the training process, average relative errors were 4.98%. It showed good agreement with experimental data. A sensitivity analysis was performed to understand relative importance of each flow parameter. In order to evaluate the prediction capability in a posteriori sense, RANS simulations were performed for turbulent bubbly flows, for which experimental data are available. For a case in the wall peaking regime, the present results were similar to the experimental data. However, for a case in the core peaking regime, the agreement with the experimental data was unsatisfactory. These errors were attributed to an issue of the shear-induced lift model. The present model combined with corrections to the shear-induced lift model by Tomiyama showed significantly improved results compared to existing models. In conclusion, both the evaluation and validation procedures showed that the present model based on ANN can estimate the bubble size reasonably well in turbulent bubbly flows.

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