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Discussion on the Applicability of Rayleigh-Plesset Equation for a Nano-scale bubble using Molecular Dynamics Simulation SHIN-ICHI TSUDA, Kyushu Univ, KAZUKI OGASAWARA, TAKUMI ITAKURA, Shinshu Univ — Multi-phase flows such as cavitation and boiling have much variety on the scale in time and space compared with single phase flows. It is necessary to recognize the multi-scale structure accurately to construct a sophisticated numerical method for the prediction of various multi-phase flow phenomena. In this point of view, clarification of the valid range of continuum mechanics would be very important. Here, an interesting problem in the case of cavitation is, to what extent Rayleigh-Plesset (R-P) equation, which describes the radius change of a spherical bubble under a pressure given at far from the bubble, can express the behavior of a tiny bubble quantitatively. In this work, we discussed the validity of the application of R-P equation to a nano-scale bubble using Molecular Dynamics (MD) simulation. In the simulation, liquid argon at a decompressed state in a cubic domain was simulated. As a result, a nano-scale bubble was generated after a waiting time, and it rapidly grew to several nanometers, and it reached to an equilibrium state showing a transient behavior. We compared the bubble radius change observed in the MD simulation with the numerical result of R-P equation, and confirmed that R-P equation can well predict the behavior of such tiny bubble.

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