Journal of Acoustical Engineering Society of Iran, Vol. 2, No. 2, 2015

A 121-velocity lattice Boltzmann method for acoustic cavitation simulation by GPU based parallel processing

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Abstract

Cavitation, a phenomenon with its desirable and unpleasant effects, is always present in two-phase flows. A great deal of research has been devoted to two-phase flow. Due to its nature, sound while propagating in a liquid will probably cause cavitation in that liquid and will interact with bubbles in it. In this paper by lattice Boltzmann (LB) method, cavitation phenomenon in a liquid under the effect of an applied sound field is considered. Lattice Boltzmann method as a mesoscopic approach, while enjoying many advantages of macroscopic level, has established itself as a capable method in modern CFD. Of its important features, are parallelizability and its easy utilization for complex boundary conditions. In this study, the power of this method is illustrated in investigating an acoustic cavitation by a 121-velocity lattice Boltzmann method using a Shan-Chen two-phase model. Although, this method has better conformity with physics of this problem but it requires more computational time than current LB methods. Utilizing the graphic processing unit (GPU) technology will compensate the long computational time required for this proposed LB model.

Keywords: Acoustic cavitation, 121-velocity lattice Boltzmann (LB) method, Graphic processing unit (GPU)

pp. 1-8 (In Persian)

[DOR: 20.1001.1.23455748.1393.2.2.1.6]

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