Accepted Manuscript

Numerical simulation of stirred tanks using a hybrid immersed-boundary method

Shengbin Di, Ji Xu, Qi Chang, Wei Ge

PII: S1004-9541(16)30507-9
DOI: doi: 10.1016/j.cjche.2016.05.031
Reference: CJCHE 584

To appear in:

Received date: 29 August 2015
Revised date: 9 March 2016
Accepted date: 18 March 2016

Please cite this article as: Shengbin Di, Ji Xu, Qi Chang, Wei Ge, Numerical simulation of stirred tanks using a hybrid immersed-boundary method, (2016), doi: 10.1016/j.cjche.2016.05.031

Fluid Dynamics and Transport Phenomena

Numerical simulation of stirred tanks using a hybrid immersed-boundary method*

Shengbin Di(狄升斌)[1,2], **Ji Xu**(徐骥)[1], **Qi Chang**(常麒)[1,3], **Wei Ge**(葛蔚)[1,**]

[1] State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100190, China

[2] University of Chinese Academy of Sciences, Beijing 100049, China

[3]School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China

Article history:

Received 29 August 2015

Received in revised form 9 March 2016

Accepted 18 March 2016

* Supported by the National Natural Science Foundation of China (21225628, 51106168, 11272312) and the "Strategic Priority Research Program" of the Chinese Academy of Sciences (XDA07080000).

** To whom correspondence should be addressed. Email: wge@ipe.ac.cn

ABSTRACT Conventionally, multiple reference frame (MRF) method and sliding mesh (SM) method are used in the simulation of stirred tanks, however, both methods have limitations. In this study, a hybrid immersed-boundary (IB) technique is developed in a finite difference context for the numerical simulation of stirred tanks. IBs based on Lagrangian markers and solid volume fractions are used for moving and stationary boundaries, respectively, to achieve optimal efficiency and accuracy. To cope with the high computational cost in the simulation of stirred tanks, the technique is implemented on computers with hybrid architecture where central processing units (CPUs) and graphics processing units (GPUs) are used together. The accuracy and efficiency of the present technique are first demonstrated in a relatively simple case, and then the technique is applied to the simulation of turbulent flow in a Rushton stirred tank with large eddy simulation (LES). Finally the