

Laboratory

CEA - Grenoble

Laboratoire de Modélisation et de Développement des Logiciels

Olivier Lebaigue

17, rue des martyrs

38054 Grenoble Cedex 9

FRANCE

e- mail: olivier.lebaigue@cea.fr

Titre du sujet de thèse

DNS applications to average model for bubble flow closures: case of the isothermal turbulent bubble column.

Summary

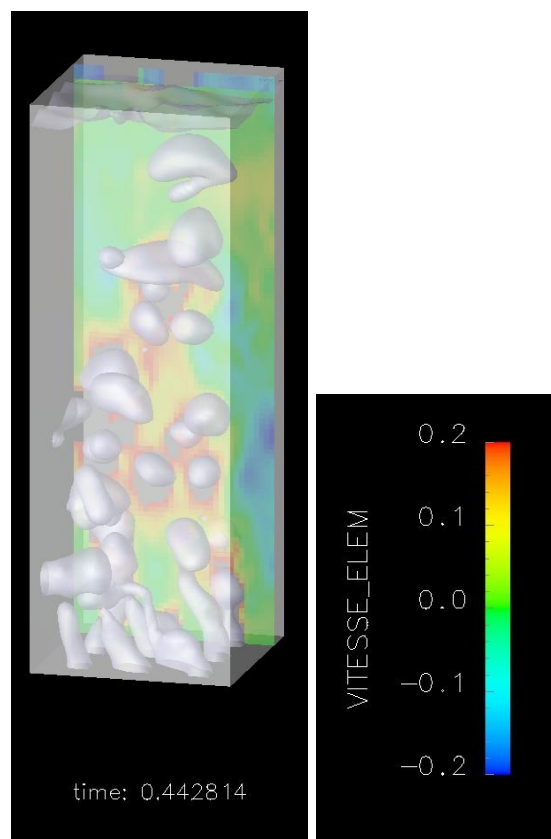
The aim of this thesis is to use DNS to produce closure relations to be used in average equation model codes. The DNS tool is the CEA platform Trio_U whereas the closure relations are to be tested within the Neptune software, co-developed within the French nuclear community (CEA, EDF, FRAMATOME and IRSN).

There exist two detailed levels of description for two-phase flow with interface tracking:

- The direct numerical simulation (DNS) where all scales are resolved and none is modeled,
- The ISS level (Interfaces and Sub-grid Scale simulation) in which the smallest scales of the phase eddies are modeled.

The detailed simulations of each bubble will be used to clarify the effects that physical phenomena (such as coalescence, fragmentation, bubble diameter distribution, buoyancy, lift forces, *etc.*) have on average equation modeling and related closure relations.

During his thesis preparation, the candidate will have access to the code Trio_U that already allows producing detailed DNS and ISS simulations on massively parallel computer. As the lab is involved in its development and validation, he can also expect that his models and closure relations will be tested in the Neptune code, in realistic industrial configurations.



Exemple de simulation 3D avec Trio_U : Colonne de bulles résultant de 9 injecteurs à la base d'une colonne à surface libre

Références bibliographiques de travaux récents

- Mathieu B.A.E., Etudes physique, expérimentale et numérique des mécanismes de base intervenant dans les écoulements diphasiques, Thèse de doctorat Université de Provence, Mention : Sciences, Spécialité : Mécanique- Énergétique, 20 novembre 2003.
- Labourasse E., Toutant A. & Lebaigue O. 2004, Interface-turbulence interaction, Paper No. 268, 5th International Conference on Multiphase Flow (ICMF 2004), Yokohama, Japan, 31st May - 3rd June 2004.
- Mathieu B., A 3D parallel implementation of the front-tracking method for two-phase flows and moving bodies, Article#24, 177ème Session de la SHF, Advances in the modelling methodologies of two-phase flows, Lyon, France, 24- 26 novembre 2004.
- Labourasse E., Lacanette D., Toutant A., Lubin P., Vincent S., Lebaigue O., Caltagirone J.P. & Sagaut P., Toward the use of LES for two-phase flows: governing equations and a priori test on isothermal calculation cases, 53 p., submitted to Int. J. Multiphase Flow, October 2005.
- Toutant A., Labourasse E., Lebaigue O. & Simonin O., Interaction between a deformable buoyant bubble and a homogeneous isotropic turbulence, Conference on Turbulence and Interactions 2006, Porquerolles, France, 29 mai–2 juin 2006.
- Vincent S., Larocque J., Lacanette D., Toutant A., Lubin P., Lebaigue O., Labourasse E., Caltagirone J.-P. & Sagaut P., Governing equations and a priori tests for the LES of two-phase flows, Conference on Turbulence and Interactions 2006, Porquerolles, France, 29 mai–2 juin 2006.
- Toutant A., Vincent S., Lebaigue O., Lubin P., Labourasse E. & Lacanette D., Effects of turbulence on interfacial heat transfer: a priori test and filters evaluation IHTC'13, Sydney, Australia, 13- 18 August 2006.