

## Accurate calculation of heat transfer coefficients for motions around particles with a finite-size particle approach

Mohamed-Amine Chadil<sup>1,2</sup>, Stéphane Vincent<sup>3</sup>, Jean-Luc Estivalezes<sup>1,4</sup>

<sup>1</sup> *Institut de Mécanique des Fluides de Toulouse, IMFT, Université de Toulouse, CNRS, Toulouse, France*

<sup>2</sup> *Institut de Mécanique et d'Ingénierie, I2M, Université de Bordeaux, CNRS, France*

<sup>3</sup> *Université Paris-Est Marne-La-Vallée, Laboratoire MSME, UMR CNRS 8208, France*

<sup>4</sup> *The French Aerospace Lab, ONERA, Toulouse; France*

The calculation of heat transfer between fluid and a set of particles is a complex task as soon as the simulation mesh is not adapted to the shape of the particles. In the present work, an Implicit Tensorial Viscous penalty method is used [1] to resolve the flow. A new Lagrange extrapolation coupled to a Taylor interpolation of high order [3] is extended for estimating heat transfer coefficients on isolated sphere, a fixed Faced-Centered Cubic arrays of spheres and a random packed spheres. The simulated heat transfers are compared to various existing Nusselt laws of the literature. The numerical convergence and accuracy of the method is also discussed. An illustration of obtained results is given in figure 1 for FCC arrangement of spheres.

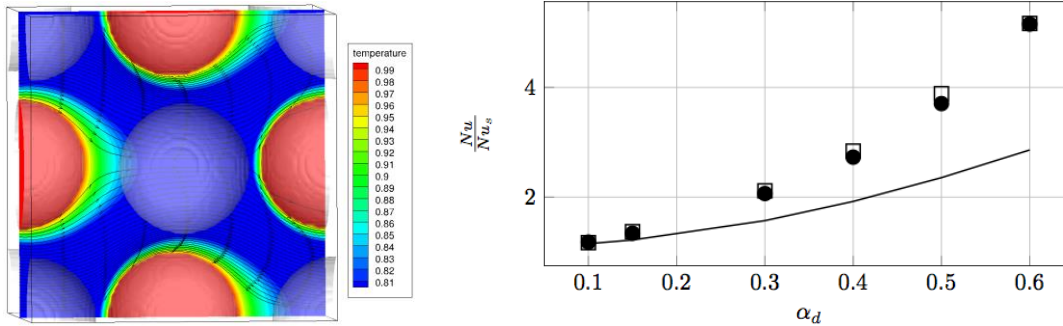


Figure 1: left: temperature field around a FCC arrays of spheres for  $Re=50$ ,  $\alpha_d = 0.5$  - right: dimensionless heat transfer coefficient for different solid volume fraction at  $Re=100$ : ( $\square$ ) Massol[4], ( $-$ ) Gun[5], present work. ( $\bullet$ )

[1] S. Vincent, J.C. Brändle de Motta, A. Sarthou, J.-L. Estivalezes, O. Simonin, E. Climent, A Lagrangian VOF tensorial penalty method for the DNS of resolved particle laden flows, *J. Comput. Phys.*, 256, pp. 582-614, 2014

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[3] A. Massol. Simulations numériques d'écoulements à travers des réseaux fixes de spheres monodisperses et bidisperses, pour des nombres de Reynolds modérés. PhD thesis, 2004

[4] Gunn, D.J., 1972. Transfer of heat or mass to particles in fixed and fluidized beds. *Int. J. Heat Mass Transfer* 21, 467-476.