MODELLING COLLISION AND COALESCENCE FOR PARTICULATE AND BUBBLY FLOWS

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This Diploma Course project lies within the scope of MuTEch, which is an IWT-SBO funded project dealing with the simulation of multiphase transport phenomena in electrochemical processes. It involves research on a large range of scales as well as multi-phase flow, turbulence and heat transfer. In electrochemical processes, reactions between the electrodes and the electrolyte may produce gas bubbles, which interact with the carrier flow. The flow of the electrolyte can be of turbulent nature.

To simulate dispersed turbulent two-phase flows (i.e. flows with particles or bubbles), the Lagrangian solver PLaS was developped at VKI. It allows to track the trajectories of bubbles, droplets and particles inside a continuous carrier fluid using the Eulerian-Lagrangian method[1]. PLaS is designed to be coupled to various incompressible Navier Stokes solvers (Morpheus, SFELES, Coolfluid). In the present work, PLaS is interfaced to Morpheus, which is a parallel unstructured 3D finite element solver[2].

The aim of this Diploma Course project is to add two additional modules to the PlaS code, which represent physical mechanisms in dispersed two phase flows:

1. Sommerfeld's stochastic collision model[3], which takes into account collisions between particles.
2. A model to take into account coalescence in bubbly flows[4].

Both modules chosenare of stochastic nature. Thus direct interaction between particles or bubbles, which is computationally expensive, can be avoided. Instead, collisions and coalescence are modelled according to averaged quantities of the dispersed phase (particle velocities, volume fraction).

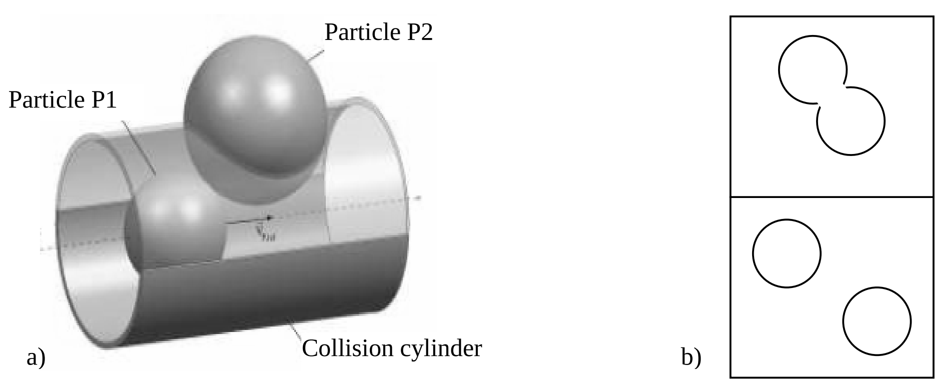

Figure 1: a) Scheme[5] of the collision approach, b) Coalescence between two bubbles

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[3] M. Sommerfeld: Validation of a stochastic Lagrangian modelling approach for inter-paticle collisions in homogeneous isotropic turbulence, *International Journal of Multiphase flow*, Vol.27, pp. 1829-1858 (2001).
[4] D. Bröder, M. Sommerfeld: Examination of bubble collisions and coalescence in bubbly flows, *In: Bubbly flows - analysis, modelling and calculation*, Springer Verlag, Berlin/Heidelberg Germany (2004).
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