ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
CAMPUS DI FORLÌ

Teaching room 3, via Fontanelle 40, Forlì

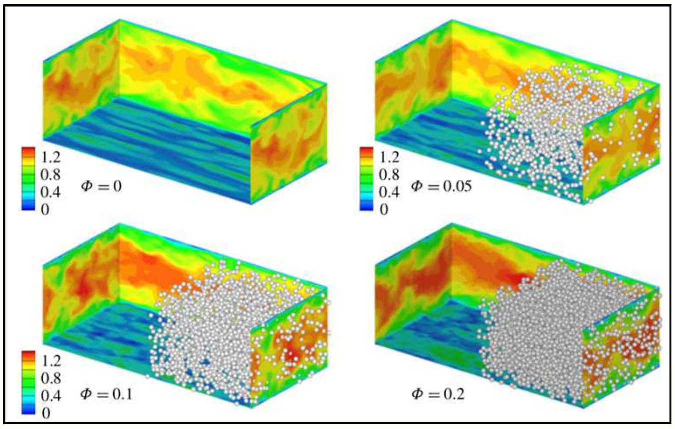
Thursday, May 16th 2019 at 3.00pm

Direct Numerical Simulations in particle laden flows

Francesco Picano
Associate Professor
Dep. of Industrial Engineering
Università degli Studi di Padova

Dense particle suspensions are widely encountered in many applications and in environmental flows. While the large part of studies investigates their rheological properties in laminar flows, little is known on the behavior of these suspensions in the inertial and turbulent regimes. The present talk aims to fill this gap by discussing the transitional and turbulent behavior of a Newtonian fluid laden with neutrally-buoyant rigid spheres at relatively high volume fractions in a plane channel. The dataset has been obtained by interface-resolved direct numerical simulation (IR-DNS) using an immersed boundary method (IBM) to account for the dispersed phase. This technique, although computationally expensive, provides an extremely accurate description of the particle-fluid interactions and opens new perspectives for research.

The results show that usual phenomenology and laws are significantly altered by the presence of a dense solid phase. In particular, the transition to turbulence is completely altered by the particulate phase. It will be shown that actually dense suspensions deal with three different dynamical states whose transition depends on the Reynolds number and the volume fraction. Focusing on the fully turbulent regime, the overall drag is found to increase with the volume fraction, more than one would expect if just considering the increase of the system viscosity due to the presence of the particles. The classical single-phase law of the wall is also strongly altered. It will be shown that important effects are caused by the finite size of the particles. Based on this observation, a revision of the law of the wall is proposed in order to account the effect of a solid dispersed phase.



Contacts: Prof. Elisabetta De Angelis, email: e.deangelis@unibo.it