Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A metamodel for the apparent permeability tensor of three-dimensional porous media in the inertial regime[1] NICOLA LUMINARI, CHRISTOPHE AIRIAU, Institut de Mécanique des Fluides de Toulouse, ALESSANDRO BOTTARO, DICCA, Scuola Politecnica, Universitá di Genova —
In the description of the homogenized flow through a porous medium saturated by a fluid, the apparent permeability tensor is one of the most important parameters to evaluate. In this work we compute numerically the apparent permeability tensor for a 3D porous medium constituted by rigid cylinder using the VANS (Volume-Averaged Navier-Stokes) theory. Such a tensor varies with the Reynolds number, the mean pressure gradient orientation and the porosity. A database is created exploring the space of the above parameters. Including the two Euler angles that define the mean pressure gradient is extremely important to capture well possible 3D effects. Based on the database, a kriging interpolation metamodel is used to obtain an estimate of all the tensor components for any input parameters. Preliminary results of the flow in a porous channel based on the metamodel and the VANS closure are shown; the use of such a reduced order model together with a numerical code based on the equations at the macroscopic scale permit to maintain the computational times to within reasonable levels.

[1]The authors acknowledge the IDEX Foundation of the University of Toulouse 570 for the financial support granted to the last author under the project Attractivity Chairs.

Nicola Luminari
Institut de Mécanique des Fluides de Toulouse

Date submitted: 24 Jul 2017 Electronic form version 1.4