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# A nonlinear asymptotic model for the inertial flow at the interface of a permeable medium

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A two- or three-dimensional nonlinear model for the inertial incompressible viscous fluid flow at a fluid-porous interface is proposed [1]. The interfacial region between the pure fluid and the homogeneous porous region is viewed as a thin transition porous layer characterized by evolving heterogeneities [2-4]. An asymptotic analysis [5] is applied to the homogenized Navier-Stokes equation giving rise to nonlinear jump conditions for the momentum transport with inertia at the equivalent dividing interface. These jump conditions involve slip and friction coefficients whose dependence on the porosity are analyzed. In addition, we show that the global work of the inertial forces in the fluid and porous regions has always a positive contribution at the interface to the dissipation of kinetic energy inside the whole system. To our knowledge, this innovative asymptotic model is the first multi-dimensional nonlinear model proposed in the literature for the inertial flow. Moreover, it clearly opens new perspectives to study turbulent flows at the fluid-porous interface.

## References

[1] P. Angot, B. Goyeau, J. A. Ochoa-Tapia, submitted to Physics of Fluids (2017).

[2] B. Goyeau, D. Lhuillier, D. Gobin, and M. G. Velarde, Int. J. Heat Mass Transfer 46, 4071 (2003).

[3] F. J. Valdés-Parada, C. G. Aguilar-Madera, J. A. Ochoa- Tapia, and B. Goyeau, Adv. Water Res. 62, 327 (2013).

[4] P. Angot, B. Goyeau, and J. A. Ochoa-Tapia, Phys. Rev. E 95, 063302 (2017).

[5] P. Angot, F. Boyer, and F. Hubert, Math. Model. And Numer. Anal. 43, 239 (2009).

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