Darcy's law for inhomogeneous incompressible flows

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Abstract

We investigate the homogenization of a density-dependent incompressible fluid confined to a bounded three-dimensional perforated domain. Assuming that the perforations are large enough, when letting the number of inclusions go to infinity by shrinking them at the same time, we will show that the limiting (effective) equation is given by a density-dependent incompressible Darcy law. Additionally, we will give convergence rates, as well as the existence of a strong solution to the limiting system. This is joint work with Danica Basarić (Politecnico di Milano) and Jiaojiao Pan (Nanjing University).

Keywords: Homogenization; Non-homogeneous; Navier-Stokes system; Darcy's law

References

[1] D. Basarić, F. Oschmann, and J. Pan, *Qualitative derivation of a density dependent incompressible Darcy law*, arXiv preprint arXiv:2502.14602, 2025.