Global in time solutions for the Incompressible Porous Media equation (IPM)

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Abstract

The dynamics of an incompressible fluid through a porous medium (IPM) is a complex and not thoroughly understood phenomenon. We use Darcy’s law as the momentum equation to describe the evolution of the fluid. Although it presents many similarities with other active scalar equations, there is a key feature that distinguishes it among this class. There is a relevant direction, due to gravity, that breaks the symmetry of the problem. Physically, this property of the equation has a simple interpretation, a heavier fluid underneath a lighter fluid tends to stabilize the dynamics. In this talk, we will present two global existence results for the IPM in two different settings: 1) the density takes two different constant values (known as the Muskat problem) and 2) the case where the density has a smooth transition.