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Adem Cakmak* (cakmak@ohio.edu), OHIO UNIVERSITY LANCASTER, 1570 GRANVILLE PIKE, Lancaster, OH 43130-1037. *Analysis of nonlinear Darcy-Forchheimer flows in porous media.*

This work is focused on certain theoretical aspects of nonlinear non-Darcy flows in porous media, and their application in reservoir and hydraulic engineering. The goal of this work is to develop a mathematically rigorous framework to study the dynamical processes associated to all three classical nonlinear Forchheimer laws for slightly compressible fluids. In our approach each anisotropic Forchheimer equation is replaced by a constitutive equation which relates the velocity vector field with the pressure gradient in a non-linear way. This allows reducing the original system of equations to one degenerate parabolic equation for the pressure only. It is shown that under some hydrodynamic and thermodynamic constraints there exists stable equilibrium: pseudo-steady state regime for the Forchheimer flows in porous media, which serves as a global attractor for wide classes of the flows yielding an alternative time independent computation of productivity index/diffusive capacity of a well. (Received September 22, 2009)