Texas Tech University. Applied Mathematics Seminar.

Generalized Forchheimer Equations for Porous Media: Part V

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ABSTRACT. The non-linear Forchheimer equations are considered as laws of hydrodynamics in porous media in case of high Reynolds numbers, when the fluid flows deviate from the ubiquitous Darcy's law. In this talk, the dynamics of generalized Forchheimer equations for slightly compressible fluids are studied by means of the resulting initial boundary value problem for the pressure. We prove that the solutions depend continuously on the boundary data both in finite time and at time infinity. In contrast to related long-time dynamics results which are in the L^2-context and require a restriction on the degree of the Forchheimer polynomial, the results obtained here are for general L^α-spaces and without this degree restriction. New bounds for the solutions are established in L^α-norm for all $\alpha \geq 1$, and then are used to improve estimates for their spatial and time derivatives. New Poincaré-Sobolev inequalities and non-linear Gronwall-type estimates for non-linear differential inequalities are utilized to achieve better asymptotic bounds. The methods developed are general and can be applied to other degenerate parabolic equations of similar structure.
This is joint work with Akif Ibragimov, Thinh Kieu and Zeev Sobol.