Weak solutions for the Stokes system for compressible fluids with general pressure

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Abstract

We prove existence and uniqueness of global in time weak solutions for the Stokes system for compressible fluids with a general, non-monotone pressure. We construct the solution at the level of Lagrangian formulation and then define the transformation to the original Eulerian coordinates. For nonnegative and bounded initial density the solution is also nonnegative for all t and belongs to $L^\infty([0,\infty) \times \mathbb{T}^d)$. A key point of our considerations is the uniqueness of such transformation. Since the velocity might not be Lipschitz continuous, we develop a method which relies on the results of Crippa & De Lellis, concerning regular Lagriangian flows. The uniqueness is obtained thanks to the application of a certain weighted flow and detail analysis based on the properties of the BMO space.