In [10], we construct global $L^\infty$ entropy weak solutions to the initial boundary value problem for the 1D damped compressible Euler equations on bounded domain with physical boundaries. The global existence of entropy weak solutions was achieved by means of Godunov scheme [4] and the compensation compactness frameworks established by [2], [3], [7], [8], [9] and [12]. Time asymptotically, the density is conjectured to satisfy the porous medium equation and the momentum obeys to the classical Darcy’s law. Adopting the new framework introduced by [5] and [6] based on entropy principle, we showed that the physical weak solutions converges to steady states exponentially fast in time. We also proved that the same is true for the related initial boundary value problems of porous medium equation and thus justified the validity of Darcy’s law in large time.

In [11], under the assumption that the initial perturbation around equilibrium state is small, we proved global existence and uniqueness of classical solutions to the initial boundary value problem for the 3D damped compressible Euler equations on bounded domain with slip boundary condition. The global existence and uniqueness of classical solution was proved by using some special energy estimates introduced in [1], which strongly depend on the estimate of $\nabla U$ by $\nabla \times U$ and $\nabla \cdot U$. Meanwhile, the exponential decay to steady state of the classical solution was achieved. We also proved that the same is true for the related problem of porous medium equation even if the initial data is rough and large.

References


