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*Entropy method for hypocoercive BGK and Fokker-Planck equations*

**Abstract**

The entropy method is a powerful tool for analyzing the large-time behavior of the Cauchy problem for linear and non-linear Fokker-Planck type equations (advection-diffusion equations). The essence of the method is to derive a differential inequality between the first and second time derivative of the relative entropy.

For degenerate parabolic equations, the entropy dissipation may vanish for states other than the equilibrium. Hence, the standard entropy method does not carry over. For hypocoercive Fokker-Planck equations we introduce an auxiliary functional (of entropy dissipation type) to prove exponential decay (with sharp rates) of the solution towards the steady state.  Finally, we extend the method to the kinetic Fokker-Planck equation (with non-quadratic potential), non-degenerate non-symmetric Fokker-Planck equations and BGK models.

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