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Short- and long-time behavior in evolution equations: the role of the hypocoercivity index

Wednesday 28 May 2025 12:00 (30 minutes)

The "index of hypocoercivity" is defined via a coercivity-type estimate for the self-adjoint/skew-adjoint parts of the generator, and it quantifies 'how degenerate' a hypocoercive evolution equation is, both for ODEs and for evolutions equations in a Hilbert space. We show that this index characterizes the polynomial decay of the propagator norm for short time and illustrate these concepts for the Lorentz kinetic equation on a torus.

Discrete time analogues of the above systems (obtained via the mid-point rule) are contractive, but typically not strictly contractive. For this setting we introduce "hypocontractivity" and an "index of hypocontractivity" and discuss their close connection to the continuous time evolution equations.

References:
1) F. Achleitner, A. Arnold, E. Carlen, The Hypocoercivity Index for the short time behavior of linear time-invariant ODE systems, J. of Differential Equations (2023).
2) A. Arnold, B. Signorello, Optimal non-symmetric Fokker-Planck equation for the convergence to a given equilibrium, Kinetic and Related Models (2022).
3) F. Achleitner, A. Arnold, V. Mehrmann, E. Nigsch, Hypocoercivity in Hilbert spaces, J. of Functional Analysis (2025).

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