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## **FIRST PRINCIPLES AND DYNAMICS IN KINETIC SYSTEMS**

Abstract: Kinetic systems form an important subclass of positive polynomial systems with a wide application domain that include chemical and biochemical reaction networks, transportation networks, population models, etc. They possess a strong structure that can be characterized by graphs that enables to apply robust parameter-independent methods for their dynamic analysis and controller design.

The underlying first principles of kinetic models including conservations and entropy related thermodynamical laws open up the way to develop special methods for the analysis of their stability and delay related properties. It will be shown how to derive and use entropy-based Lyapunov functions for kinetic systems, and how to determine the input-output delays of distributed kinetic systems from the properties of spatially distributed transport mechanisms, such as convection and diffusion.