
On the bulk velocity of Brownian ratchets

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Abstract

Brownian ratchet is a generic term for a few micro-level mechanisms in physics and biology that are capable of producing unidirectional transport of matter in systems without apparent bias to a particular direction. We study the transport phenomenon for ratchets modeled by a Fokker–Planck-type equation on the real axis. We establish a relation between the bulk transport velocity and a bi-periodic solution of the equation. This relation allows to characterise the transport for a few specific models such as adiabatic and semiadiabatic limits for tilting ratchets, generic ratchets with small diffusion, and the multi-state chemical ratchets. This includes qualitative results concerning the direction of transport as well as explicit asymptotic formulas for the bulk velocity. This is a joint work with J.M. Urbano and D. Vorotnikov (University of Coimbra).

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