On the bulk velocity of Brownian ratchets

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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. In this talk we study the transport phenomenon for rachets 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. We use this relation 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 multistate chemical ratchets. We obtain qualitative results concerning the direction of transport as well as explicit asymptotic formulas for the bulk velocity.