

Brownian motion with a nonlinear friction

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There are many important situations when the damping constant in the Langevin equation depends on the velocity of the Brownian particle. Such velocity dependence is encountered, for example, in models of active motion of biological objects. For such motion the linear Stokes law does not apply and the friction force on the particle is described by various functions nonlinearly depending on the velocity. In the present contribution we consider the case when this force is given by a power law function $\sim v^a$. The diffusion coefficient D of the particle is calculated for arbitrary constant a , including the negative one, as a function of the intensity of the white noise driving the particle. In particular, interesting cases are considered when D does not depend at all on the noise intensity or when it even decreases with the increase of the noise. The Langevin equation is studied also as a noise generator and the problem of designing a generator with desired properties of the colored noise is addressed.