Memory effects in overdamped systems

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We consider the effects of memory on the stationary behavior of a two-dimensional Langevin dynamics in a confining potential. The system is treated in an overdamped approximation and the degrees of freedom are under the influence of distinct kinds of stochastic forces, described by Gaussian white and colored noises, as well as different effective temperatures. The joint distribution function is calculated exactly by means of time-averaging techniques, and the long-term behavior is analyzed. We determine, by using the stochastic thermodynamics formalism, the influence of noise temporal correlations on the energetics in the steady-state regime. As a result, we find that non-Markovian effects lead to a decaying heat exchange with spring force parameter, which is in contrast to the usual linear dependence obtained when only Gaussian white noises are presented in overdamped treatments. In addition, the memory time-scale affects in a nontrivial fashion the entropy production rate associated with stationary states.