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Control theory in the study of mixing properties of networks of oscillators interacting with thermal baths

We discuss the use of elements of control theory as an alternate tool for showing exponential convergence to a unique stationary measure for certain classes of networks of classical oscillators interacting with thermal baths at different temperatures. With the system of oscillators expressed in the form $\mathrm{d}X_t = AX_t\,\mathrm{d}t + F(X_t)\,\mathrm{d}t + B\,\mathrm{d}W_t$ in $\mathbf{R}^d$, where A encodes the harmonic part of the force and $-F$ corresponds to the gradient of the anharmonic part of the potential, the hypotheses under which we obtain exponential mixing are the following: A is dissipative, the pair (A, B) satisfies the Kalman condition, F grows sufficiently slowly at infinity (depending on the dimension d), and the vector fields in the equation of motion satisfy a weak Hörmander condition in at least one point of the phase space.