14.4: Relation between the Dynamic Friction Kernel and the Random Force

From the definitions of $R(t)$ and $\zeta(t)$, it is straightforward to show that there is a relation between them of the form

$$\langle R(0)R(t)\rangle = kT\zeta(t)$$

This relation is known as the *second fluctuation dissipation theorem*. The fact that it involves a simple autocorrelation function of the random force is particular to the harmonic bath model. We will see later that a more general form of this relation exists, valid for a general bath. This relation must be kept in mind when introducing models for $R(t)$ and \zeta(t). In effect, it acts as a constraint on the possible ways in which one can model the random force and friction kernel.