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Markovian reduction of Brownian particle dynamics

A non-Markovian process can be embedded in a Markovian one by enlarging the set of variables. In the same spirit the description of an open quantum system can be Markovian or non-Markovian depending on the degrees of freedom which can be observed rather than being part of the environment. We will provide examples of this behavior, considering in particular the case of a Brownian particle coupled to a bath of harmonic oscillators obeying the generalized Langevin equation. The result builds on an explicit recurrence relation for the spectral densities describing the residual effective bath obtained including selected degrees of freedom in the system. The obtained sequence of spectral densities is shown to quickly converge to a quasi-Ohmic expression.

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