Restoring the continuum limit in the time-dependent numerical renormalization group approach

Frithjof Anders

Lehrstuhl theo. Physik II, Fakultät Physik, Technische Universtät Dortmund, Otto-Hahn Str 4, 44227 Dortmund, Germany

The continuous coupling function in quantum impurity problems is exactly partitioned into a part represented by a finite-size Wilson chain and a part represented by a set of additional reservoirs, each coupled to one Wilson chain site. These additional reservoirs represent high-energy modes of the environment neglected by the numerical renormalization group and are required to restore the continuum limit of the original problem. We present a hybrid time-dependent numerical renormalization group approach which combines an accurate numerical renormalization group treatment of the nonequilibrium dynamics on the finite-size Wilson chain with a Bloch-Redfield formalism to include the effect of these additional reservoirs. Our approach overcomes the intrinsic shortcoming of the time-dependent numerical renormalization group approach induced by the bath discretization with a Wilson parameter $\Lambda>1$. For the numerical solution of this master equation, a Lanczos method is employed which couples all energy shells of the numerical renormalization group. The presented hybrid approach is applied to the real-time dynamics in correlated fermionic quantum impurity systems.

This work was supported by Deutsche Forschungsgemeinschaft Project No AN 275/10-1..