# Transport through a finite Hubbard chain connected to reservoirs: Numerical Renormalization Group approach

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We consider a finite Hubbard chain of size $N$ $(= 1, 2, 3, \ldots)$ connected to two noninteracting leads, as a model for small systems, such as a series of quantum dots or the materials on a nanometa scale. This model was studied previously [1-2] with the second-order perturbation theory with respect to the Coulomb repulsion $U$. The perturbation method is known to give the low-energy behavior of the local Fermi-liquid correctly at least qualitatively [3-4]. The results of the conductance through the Hubbard chain shows an even-odd oscillatory behavior at half-filling as a function of the size $N$ [1-2]: for odd $N$ the perfect transmission occurs due the resonance state appearing at the Fermi level, while for even $N$ the conductance decreases with increasing $N$ showing a tendency towards the development of a Mott insulator gap. In this report, in order to clarify these aspects caused by the electron correlation accurately, we reexamine the low-energy properties using a nonperturbative approach, i.e., the numerical renormalization group method, which has been applied to the system of quantum dots successfully [5-6]. We calculate the renormalized parameters of the quasi-particle Hamiltonian [7], and deduce the conductance at $T = 0$ using a Fermi-liquid description for the transport through small interacting systems [1-2]. The temperature dependence and the transmission coefficient of the quasi-particle with finite energies will also be discussed.

## References

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