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Solution of electric-field-driven tight-binding lattice in contact with fermion reservoirs[1] JONG HAN, SUNY at Buffalo — Electrons in tight-binding lattice driven by DC uniform force field dissipate their energy through on-site fermionic thermostats. Due to the translational invariance in the transport direction, the problem can be block-diagonalized. We solve this time-dependent quadratic problem and demonstrate that the problem has an oscillatory steady-state. The steady-state occupation number shows that the Fermi surface disappears for any damping from the thermostats and any finite electric field. Despite the lack of momentum scattering, the conductivity takes the same form as the semi-classical Ohmic expression from the relaxation-time approximation. Despite the similarity of the Ohm's law with the Boltzmann transport, this solution does not support gradual shift of Fermi surface by drift velocity and, therefore, when used for many-body steady-state calculations, may lead to pathological effects. We discuss extensions of this model for more realistic dissipation mechanisms.

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