Quantum Quenches in one dimension: A renormalization group approach

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The time-evolution of one-dimensional bosons after a simultaneous interaction and commensurate lattice quench is studied using a renormalization group (RG) approach. As a consequence of the quench, the effective scaling dimension of the lattice potential is found to be time-dependent which has a crucial effect on the time-evolution of the system. For certain quench protocols a critical time is found at which the lattice potential goes from being irrelevant to relevant in the RG sense indicating a dynamical phase transition. Explicit results are presented for the time-evolution of various parameters when the lattice potential is irrelevant at all times. When the lattice potential becomes relevant, results are presented for the time-evolution of the gap which may be tested experimentally via quantities such as the optical conductivity. It addition to the above effects, it is shown via RG that a quench can lead to the generation of new terms such as dissipation and noise even though the system is closed. The physical origin of this dissipation is explained. It is also shown how a dissipation may be generated in closed fermionic systems after a quantum quench.