Nonlinear Sciences > Chaotic Dynamics

Slow relaxation to equipartition in spring-chain systems

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In this study, one-dimensional systems of masses connected by springs, i.e., spring-chain systems, are investigated numerically. The average kinetic energy of chain-end particles of these systems is larger than that of other particles, which is similar to the behavior observed for systems made of masses connected by rigid links. The energetic motion of the end particles is, however, transient, and the system relaxes to thermal equilibrium after a while, where the average kinetic energy of each particle is the same, that is, equipartition of energy is achieved. This is in contrast to the case of systems made of masses connected by rigid links, where the energetic motion of the end particles is observed in equilibrium. The timescale of relaxation estimated by simulation increases rapidly with increasing spring constant. The timescale is also estimated using the Boltzmann-Jeans theory and is found to be in quite good agreement with that obtained by the simulation.

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