Estimation of the spectral gap in an interacting particle system modelling heat conduction. Monte Carlo approach

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Abstract

This thesis studies an interacting particle system originating from the heat conduction problem. Our simple model contains particles, which interact with each other at random times. It is important to note, that in our model every two particles can interact. Each particle has a non-negative energy, and the time between interactions of two particles depends on their energies. It should be further noted, that the process of energy exchange in this system is a continuous time Markov chain. The problem we are trying to solve is the estimation of the spectral gap of this system. More precisely we are interested in the dependency between the number of particles in the system and the spectral gap, as it is important in studying Fourier's law of heat conduction on micro level. We estimate the spectral gap by simulating the system and looking at the correlation decays of different observables. While this research can not provide very accurate estimates, it gives some insight into the method and its application to this problem, as well as its weak points.