

Abstract

Olivér Nagy

Mathematics MSc 2022

In my thesis, the aim is to study an interacting particle system of thermodynamical origin. In particular, we are interested in the spectral gap of systems in which neighboring particles exchange energy randomly. The spectral gap can be interpreted as the speed of convergence to the stationary distribution, and as well as the absolute value of the largest, non-zero eigenvalue of the infinitesimal generator of the process. There are many versions of the model, as the rates at which the particles redistribute energy can be chosen in a number of ways, and the same applies for the random variables which determine how the energy is exchanged.

A motivation for this is that in 2015, Makiko Sasada published a paper in which she gave a lower bound for a homogeneous version of these models, and this version covers the Markov energy process appearing in the rare interaction limit of the famous Gaspard-Gilbert disk model. The long-term goal would be to generalize her proof to another, non-homogeneous model, which covers the modified, non-homogeneous Gaspard-Gilbert model.

However, for this thesis, a precise calculation of it would be rather difficult, we used numerical approximation. A code was implemented in Python for the estimation. Using this code, we estimated the spectral gap of one specific model, and interestingly, at the moment, our results do not confirm Sasada's result.