**Single species annihilation**

Simulations of a single-species annihilation reaction on hypercubic lattices as a function of the lattice spatial dimension

Consider lattice dimensions , and choose a lattice size large enough (such that the results do not depend on ). For hypercubic lattices. Apply periodic boundary conditions in all lattice directions. Introduce the lattice site occupation variable

Assume for all **.**

Simulation approach 1

At each time step

1. Choose one lattice site randomly
2. A) If the chosen lattice site is occupied by a particle ( on that site), that particle performs one random jump to one of the neighboring lattice sites with the probabilities

If the new position is occupied, annihilate both particles (set on the sites from where the particle started and ended). If the new position is empty, the particle stops at the new position. Go to item #3 below.

B) If the chosen lattice site is empty, do nothing and go to item #3 below.

1. Update time

Plot the average (over many simulations with different seeds for the random number generator) number density as a function of time for . In this approach

Simulation approach 2, “rejection free”

A randomly chosen lattice site must be occupied. All the other steps are as above. For this you will need at each time a list of occupied lattice sites (keep in mind that the list is time-dependent).

In this approach the time step .

Plot the average number density as a function of time for