

Computational Quantum Physics Exercise 10

Problem 10.1 Classical Wolff algorithm

Implement the Wolff algorithm for the classical Ising model. In order to keep the implementation more general, you should implement it for an arbitrary adjacency list instead of a specific lattice. We will need this in next week's exercise.

We suggest that you store the adjacency list such that for each site of the lattice, you keep a list of pairs containing the adjacent sites. Implement improved estimators (Section 7.2.3 of the script) to measure the susceptibility

$$\chi_2 = \sum_n \sigma_0 \sigma_n \quad (1)$$

and the second moment

$$\mu_2 = \sum_n \sigma_0 x_n^2 \sigma_n, \quad (2)$$

where x_n is the minimum distance (including periodic boundary conditions) between the two spins. As a test for this week, construct the adjacency list for the square lattice and compare to the known result for this lattice with $J = 1$ on all bonds.