## 8.1 Introduction

In a more fundamental discussion thermodynamic equilibrium is described by a statistical approach. This is true as well for all mechanisms leading to thermodynamic equilibrium, e.g. transport and scattering processes. Brownian motion of tiny particles is a typical example for this.
This fundamental randomness can be used in a famous mathematical concept to simulate transport phenomena, the "path" to thermodynamic equilibrium, and thermodynamic equilibrium properties of physical systems. To emphasize the statistical character this mathematical approach is called "Monte-Carlo-Simulation". It is fundamentally a numerical approach on a computer. Each micro-state within a thermodynamic system is defined by the set of values for each variable of each particle. The Monte-Carlo simulation will modify successively the micro-state by "testing" other values of these parameter. Random numbers generated within a computer program can be used for three different purposes

- Specifying the parameter which will be tested next.
- Specifying a new value for this parameter.
- Accept the parameter change with a certain probability depending on the energy change related to the value change.

With nowadays increasing computer power (Monte-Carlo-)simulation become even more popular and relevant. Many different versions of Monte-Carlo-simulation exist optimizing efficiency, stability, and accuracy of the algorithms. Here we only will discuss briefly one of the oldest but due to it's simplicity still very important algorithms.