

## 1 Overview

In the last lecture we discussed non-linear dynamics.

In this lecture we will talk about the basic idea of the Monte Carlo method and Percolation model

## 2 The basic idea of the Monte Carlo method

Lecture starts from historical introduction fully described on slides 2,3 and 4.

We will learn metropolis algorithm to deal with Agent base modelling. Required knowledges: large numbers on the probability.

Examples of using this method:

- Approximating areas of geometric figures

### Project

Groups of 3 or 4 students.

Choose one microscopic model.

Write it to professor so she can recommend something.

## 3 Percolation

Example of microscopic model: **Percolation**

Coffee filter: if you press really dense - water flows slowly. Same with water filter: if you have too loose filter - water flows fast but not filter.

**Question:** what dense should be?

To answer this we can use percolation model.

### 3.1 Side(place) percolation

All sites are, independently of each other, chosen to be occupied with probability  $p$  and empty with probability  $1 - p$ . How:

- Choose random number  $R$  from 0 to 1
- If  $R < p$  then occupy place.

### 3.2 Bond percolation

Same as site percolation, but we use bonds. We can imagine it like wiring system.

## 4 The Burning Method

Example simulation was shown on the professor's computer.

**Summary:** It is a step function. We always have critical point (percolation threshold). A point when filter starts to pass water.