

Course Syllabus

Random Fractals BMETE95MM46

Instructor Information:

Instructor: Prof. Károly Simon,
www.math.bme.hu/~simonk, simonk@math.bme.hu

Time and Place: BME building H on Wednesday at 08:15-10:00

All information about the course:

<http://www.math.bme.hu/~simonk/rf>

Language of instruction: English

Attendance and Class Participation: Attendance is required except reasonable excuses, which should be approved by the instructor in advance.

Text in English:

- (1) K. Falconer, Fractal Geometry, Wiley, 2003
- (2) R. Durrett Probability: Theory and Examples ed. 5
https://services.math.duke.edu/~rtd/PTE/PTE5_011119.pdf
- (3) R. Lyons, Y-Peres. Probability on Probability on trees and networks, Cambridge University Press, 2017.

Some slides related to the lectures of the course might be available at:

<http://www.math.bme.hu/~simonk/rf>

Prerequisites: No prerequisites for MSc and PhD students. Probability I for BSc students.

Requirements for the signature A 30-minute lecture presented before the end of the semester during a lecture. The topic should be approved by the instructor.

Final exam: The final exam will consist of the theorems, definitions, proofs and exercises, which are very similar to the ones we discussed in class.

Grading policy:

The 30-minute lecture: 30%, final exam: 70 %.

Grading Scale:

Fail (1)	0 -39	%
Pass (2)	40-54	%
Satisfactory (3)	55-69	%
Good (4)	70-84	%
Excellent (5)	85-100	%

Topics:

- (1) Introduction: deterministic self-similar fractals and fractal dimensions.
- (2) The introduction of the tools we use from the theory of stochastic processes: Branching processes and some elements of Large deviation theory.
- (3) Fractal percolation random sets: the construction, elementary properties and the dimension formula.
- (4) Chayes, Chayes, Durrett theorem about the connectivity property of Fractal percolation process.
- (5) The orthogonal projections of Fractal percolation sets I.
- (6) The orthogonal projections of Fractal percolation sets II.
- (7) Fractal percolation process on Sierpinski carpet and on Menger sponge.

Part II

- (1) The definition, dimension and measure of randomly perturbed self-affine sets. The self-affine transversality condition.
- (2) Generalized Transversality Condition for dominated triangular C1 IFS.
- (3) The existence of interior points in randomly perturbed self-similar sets.

Prof. Károly Simon,
27 February, 2023.