Course Syllabus
Fourier Analysis and Fractals BMETE957306

Instructor Information:
Instructor: Prof. Károly Simon,
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Time and Place: The course held fully online on Microsoft teams.
All information about the course:
http://www.math.bme.hu/∼simonk/ff
Language of instruction: English
Attendance and Class Participation: No attendance requirements for Covid-19,
Text in English:

(1) K. Falconer, Fractal Geometry, Wiley, 2003
(2) K. Falconer, The geometry of fractal sets, Cambridge, 1985
(3) K Falconer, Techniques in fractal geometry, Wiley, 1997,
(4) Pertti Mattila, Fourier Analysis and Hausdorff Dimension, Cambridge 2015.
(5) Pertti Mattila, Geometry of Sets and Measures in Euclidean Spaces, Cambridge 1995.
(6) T. Wolf, Lectures in Harmonic analysis, AMS, revised 2002.

Slides of the lectures of the course might be be available at:
http://www.math.bme.hu/∼simonk/ff
Prerequisites: No prerequisites for MSc and PhD students. Measure Theory for BSc students.
Final exam: The final exam will consists of the theorems, definitions proofs and exercises, which are very similar to the ones we discussed in class.
Grading policy:
Final exam: 100 %.
Grading Scale:

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

Topics:

(1) The best-known examples of self-similar and self-affine fractals.
(2) Hausdorff and Box-dimension. (Definition and properties.)
(3) A brief review of measure theory and covering theorems.
(4) Energy, Capacity and Frostman Lemma.
(5) The dimension of the orthogonal projections of sets and measures, the transversality method.
(6) The connection between the fact that a measure is absolute continuous with L^2 density and the fact that its Fourier transform is in L^2.
(7) Bernoulli convolutions.
(8) Salem sets and Fourier dimension.
(9) Falconer's distance set conjectures.
(10) Peres-Schlag generalized transversality method.
(11) Hochman Theorem about the dimension of self-similar measures on the line.
(12) Shmerkin-Solomyak Theorem about the absolute continuity of self-similar measures.
(13) The dimension of the trajectory of Brownian motion.

Prof. Károly Simon,
30 August, 2020.