

Thematical Seminar - Analysis on metric spaces

Analysis on metric spaces is a fairly new field whose goal is to find ways to do first-order calculus on very general and a priori not smooth metric measure spaces. In this seminar we will see how various concepts of Euclidean analysis (e.g., gradients, Sobolev spaces, Poincaré inequalities, quasiconformal mappings, etc.) can be extended to more general metric spaces. The content of the seminar is mostly based on the beautifully written book [2]. Other useful references are [4], [1] and [3]. Prerequisites for the seminar are the courses Analysis I - IV; familiarity with measure theory is helpful but not a strict prerequisite.

The seminar will start in the second week of the semester and will take place on Thursdays 15:15 - 17:00 in PER 08 room 2.52. Please register for the seminar by sending an email to Annina Iseli (annina.iseli@unifr.ch) by Thursday 23 February 2023. All talks will be distributed during the first meeting on Thursday 2 March 2023, and participation in this meeting is mandatory!

Schedule and topics

02.03.2023	Distribution of topics and overview talk
09.03.2023	Outer measures and Hausdorff measure
16.03.2023	Covering theorems
23.03.2023	Maximal functions and Riesz potential
30.03.2023	Sobolev spaces
06.04.2023	Poincaré inequalities
20.04.2023	Sobolev spaces on metric spaces
27.04.2023	Lipschitz functions
04.05.2023	Conformal modulus
11.05.2023	Upper gradients, capacity and Poincaré inequalities in metric spaces
??.05.2023	Loewner spaces (date to be fixed; no courses on 18.05.2023)
25.05.2023	Quasisymmetries part 1
01.06.2023	Quasisymmetries part 2

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References

- [1] Dmitri Burago, Yuri Burago, and Sergei Ivanov. *A course in metric geometry*, volume 33 of *Graduate Studies in Mathematics*. American Mathematical Society, Providence, RI, 2001.
- [2] Juha Heinonen. *Lectures on analysis on metric spaces*. Universitext. Springer-Verlag, New York, 2001.
- [3] Juha Heinonen, Pekka Koskela, Nageswari Shanmugalingam, and Jeremy T. Tyson. *Sobolev spaces on metric measure spaces*, volume 27 of *New Mathematical Monographs*. Cambridge University Press, Cambridge, 2015. An approach based on upper gradients.
- [4] Pertti Mattila. *Geometry of sets and measures in Euclidean spaces*, volume 44 of *Cambridge Studies in Advanced Mathematics*. Cambridge University Press, Cambridge, 1995. Fractals and rectifiability.