ЮЖНЫЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ
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Regional Mathematical Center
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International scientific online seminar on
Analysis, Differential Equations and Mathematical Physics

Coordinators: Prof. Alexey Karapetyants, Prof. Vladislav Kravchenko

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Funk-Radon transforms

Mark Agranovsky, Bar-Ilan University, Holon Institute of Technology, Israel, agranovs@math.biu.ac.il

The classical Funk-Radon-Minkowski transform evaluates integrals of functions on the unit sphere in $\boldsymbol{R}^n$ over great subspheres, i.e., intersections of the unit sphere with hyperplanes through the origin. This transform has many applications, i.e., in geometric tomography (reconstruction of bodies from areas of plane sections), medical imaging (Q-ball method in MRI) etc. The inversion formula, reconstructing the even part of the functions, was discovered by Paul Funk in 1911. Recently, a version of Funk transform (non-central transform), associated with the bunch of hyperplanes through a point (center) different form the origin, has attracted the attention of researchers. In the talk, most general version of such a transform, for families of k-planes, passing through an arbitrary fixed center, will be considered. The talk will consist of two parts. In the first one, a group-theoretical approach to description the kernel of non-central Funk-Radon transforms and obtaining inversion formulas, will be explained. The second part of the talk will be concerned with the multi-centered transforms. While a single Funk-Radon transform always has a nontrivial kernel and therefore is non-injective, the common kernel of the transforms with different centers may be trivial and hence reconstruction functions from a collection of Funk-Radon data might be possible. We will fully describe configuration of two centers providing injectivity of the corresponding paired Funk-Radon transform and discuss open problems for more than two centers. The injectivity of multi-centered transforms depends on type of certain billiard-like dynamics on the unit sphere, which, in turn, is related to action of Moebius and Coxeter groups.

A part of the results is obtained jointly with Boris Rubin.

References

[1] M. Agranovsky, *Non-central Funk-Radon transform: single and multiple*, Journal of Functional Analysis, **279**, 1–41 (2020).

*Seminar website: https://rmc.sfedu.ru/seminar. The seminar uses Microsoft Teams online platform.
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The seminar is organized by the Regional Mathematical Center of the Southern Federal University in collaboration with Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University and the special Interest ISAAC-OTHA group in Operator Theory and Harmonic Analysis.

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