Coordinators: Prof. Alexey Karapetyants, Prof. Vladislav Kravchenko

JOIN THE SEMINAR

12 May 2022, 6 pm (UTC+3)

Semiclassical Approximation with Compex Phases for Constructing Effective Plancherel-Rotach type asymptotics of 1-D and 2-D orthogonal polynomials

Sergey Dobrokhotov, Ishlinsky Institute for Problems in Mechanics, Russian Academy of Sciences, Russia,

s.dobrokhotov@gmail.com

Many orthogonal polynomials $u(n,z)$, (n is the number of the polynomial, z is its argument), for example, the Chebyshev, Hermite, Laguerre, Legendre, are determined by recurrent relations (or difference equations) of the second order. For large numbers of n, they are approximated by the exponent, trigonometric, or special functions of a complex argument. For example, Hermite polynomials are approximated by the Plancherel-Rotach formulas, in which the special function is the Airy function Ai, Legendre polynomials are approximated by the zero-order Bessel function, and so on. We discuss an approach [1] to finding asymptotics of this type that are uniform in the variable z, based on the transition from discrete equations to continuous pseudodifferential equations in the variable $x = nh$, for functions $w(x,z)$, ($u(k,z) = w(kh,z)$, where $h \sim O\ (1/n)$ is an artificial small parameter) and the subsequent application of the semiclassical approximation with complex phases to them. The developed approach is generalized for 2-D Hermitian type orthogonal polynomials $H(n_1, n_2, z, a)$ with two indices n_1, n_2. This part of the talk contains the results recently obtained together with A. I. Aptekarev and D. N. Tulyakov [2,3].

The work was supported by Government program № AAAAA20-120011690131-7.

The talk is based on joint work with Prof. Anna Tsvetkova.

Bibliography

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[2] S. Yu. Dobrokhotov and A. V. Tsvetkova, An Approach to Finding the Asymptotics of Polynomials Given by Recurrence Relations, Russian Journal of Mathematical Physics, Vol. 28, No. 2, 2021, pp. 198-223

[3] S. Yu. Dobrokhotov and A. V. Tsvetkova, Asymptotics of multiple orthogonal Hermite polynomials $H(n_1, n_2, z, \alpha)$ determined by a third-order differential equation, Russian Journal of Mathematical Physics, Vol. 28, No. 4, 2021, pp. 439-454

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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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