

Dear Colleagues!

You are cordially invited to the Seminar "Analysis and Applied Mathematics" on

Date: Tuesday, August 16, 2022

Time: 11.00-12.00 (Istanbul) = 10.00-11.00 (Ghent) = 14.00-15.00 (Almaty)

Place: Meeting room of Faculty of Engineering and Natural Sciences BAU, D-415

Zoom link: [https://us02web.zoom.us/j/6678270445?pwd=SFNmQUIvT0tRaH-](https://us02web.zoom.us/j/6678270445?pwd=SFNmQUIvT0tRaH-IDaVYrN3I5bzJVQT09)

IDaVYrN3I5bzJVQT09, Conference ID: 667 827 0445, Access code: 1

Speaker: Prof. Dr. Yury Shestopalov

University of Gävle, Gävle, Sweden

Title: On a Mathematical Theory of Invisibility and Resonance Scattering

Abstract: In the first part of the study we consider, following [1,2] and [3] eigenvalue problems for dielectric cylindrical scatterers of arbitrary cross section with generalized conditions at infinity. The problem statement enables one to take into account complex eigen-values [4]. The existence of resonance (scattering) frequencies associated with these eigen-values is proved using the approach set forth in [5,6]. The technique involves determination of characteristic numbers (CNs) of the Fredholm operator-valued functions of the problems constructed using Green's potentials [7,8]. Separating principal parts in the form of meromorphic operator pencils, we apply the operator generalization of Rouché's theorem [9,10] to verify the occurrence of CNs in close proximities of the singularities of the pole pencils. The results are illustrated in detail using the case of a dielectric cylinder of circular cross section.

In the second part of the study we develop a technique that allows one to obtain explicitly the parameter sets for canonical structures possessing circular or planar symmetry at which resonance scattering or partial invisibility are observed. The approach employs analysis of the solution expansion coefficients considered as functions of the problem parameters.

References:

[1] V. Shestopalov & Y. Shestopalov, Spectral Theory and Excitation of Open Structures, IEE Publ., London, 1995.

[2] Y. Shestopalov, Resonance Frequencies of Arbitrarily Shaped Dielectric Cylinders, Applicable Analysis, Open access, October 2021. DOI: 10.1080/00036811.2021.1992397

- [3] E. Sanchez-Palencia, *Inhomogeneous Media and Vibration Theory*, Lecture Notes in Physics 127, NY, Springer, 1980.
- [4] Y. Shestopalov, Complex waves in a dielectric waveguide, *Wave Motion*, Vol. 82, 2018, pp. 16-19.
- [5] Y. Shestopalov, Trigonometric and Cylindrical Polynomials and Their Applications in Electromagnetics, *Applicable Analysis*, February 2019, Open access, Vol. 99, no 16, pp. 2807-2822, DOI: 10.1080/00036811.2019.1584290
- [6] Y. Shestopalov, Cloaking: analytical theory for benchmark structures, *Journal of Electromagnetic Waves and Applications*, 2021, Vol. 35, No. 4, pp. 485-510
<https://doi.org/10.1080/09205071.2020.1846629>
- [7] Y. Shestopalov, On the theory of cylindrical resonators, *Math. Meths. Appl. Sci.*, Vol. 14, 1991, pp. 335-375.
- [8] Y. Shestopalov, Y. Smirnov, and E. Chernokozhin, *Logarithmic Integral Equations in Electromagnetics*, VSP, Utrecht, 2000.
- [9] I. Gohberg & E. N. Sigal, The operator generalization of a theorem on logarithmic residue and the Rouché theorem, *Mat. Sb.*, Vol. 84, 1971, pp. 607-629.
- [10] S. Steinberg, Meromorphic families of compact operators, *Arch. Rational Mech. Anal.*, Vol. 31, 1968, pp. 372-379.

Biography:

Yury Shestopalov – is now professor of mathematics at the University of Gävle, Sweden. He completed a complete university career from teaching assistant to professor and department head at Moscow State University (MSU), Karlstad University and University of Gävle (since 2013). Y. Shestopalov has been continuously teaching (since 1977) all university courses in mathematics. In 1992-1993 he created and then was head of the department of computer science at the MSU Kolmogorov Advanced Education and Science Centre (AESC)—The Kolmogorov School. Y. Shestopalov organized the teaching of computer science, programming, and foundations of applied mathematics, worked out programs and basic courses, textbooks, compendiums, and course materials. As a member of the Board of Advisors and then of the Board of Directors Y. Shestopalov initiated the Faculty of Higher

Pedagogical Education at MSU. His main scientific results and contributions are within the following areas: spectral theory of operators and its application in mathematical methods for electromagnetics; methods of solution to inverse problems and problems with uncertain data; wave propagation in nonlinear media and nonlinear operator equations; integral equations, partial differential equations; numerical methods, optimization, applied computer codes, software and program packages. Among his recent achievements are complete description of the spectrum of waves in a broad class of inhomogeneously filled waveguides and mathematical theory of inverse waveguide problems. Y. Shestopalov has authored and co-authored seven books, also published in the USA and UK, more than 90 articles in peer-reviewed journals and in total more than 200

scientific works. He supervised several PhD works; among his disciples there are active professors in mathematics, applied mathematics and electrical engineering.

Y. Shestopalov performs international cooperation as visiting professor and co heads international research projects. Since 1977 Y. Shestopalov organized more than 20 and participated in more than 60 international conferences and symposia; he is Vice-Chairman of Progress in Electromagnetics Research Symposium and Programme Committee member of several major URSI conferences.