

Online-Workshop on
“CHEBYSHEV-200”
Part of the Thematic Programme “Applied Functional Analysis and
High-Dimensional Approximation”

May 17 – 18, 2021

organized by

Aicke Hinrichs (JKU, Linz), Boris Kashin (RAS, Moscow), Denka Kutzarova (U Illinois),
Vladimir Temlyakov (U of South Carolina, Columbia), Sergey Tikhonov (CRM, Barcelona)

• Monday, May 17th, 2021

16:00 – 17:00 **Ron DeVore (Texas A&M University)**

Learning from Data: From Chebyshev to Deep Learning

Abstract:

Deep Learning (DL) is the current method of choice for recovering a function from data observations. The theoretical optimal recovery performance was already given by Chebyshev. Deep learning seeks a numerical algorithm to achieve optimality based on neural network approximation and optimization of loss functions. We discuss to what extent this approach is close to optimal.

17:00 – 18:00 **Alexander I. Aptekarev (Keldysh Institute for Applied Mathematics, Moscow State University)**

On the Sharp Constants in the Rate of Convergence of the Tchebyshev Rational Approximation for Analytic Functions

Abstract:

We discuss theorems describing sharp constants for the rate of approximation for a general class of analytic functions by rational functions. The glorious story on the sharp constants for the approximation of e^{-z} on $[0, \infty]$ was one of the most remarkable application of such type of theorems. For the proof of the theorems a construction of rational interpolants possessing Tchebyshev alternance property is proposed. The equioscillation of the error term leads to certain equilibrium problems for the logarithmic potentials for measures and for signed charges. Asymptotically sharp formulas for the interpolations points, for the points of alternance, and general theorems on the strong asymptotics for the error term of the best rational approximants are presented. The proofs are based on the strong asymptotics for polynomials orthogonal on the extremal compacts of the complex plane with respect to complex varying weights. Techniques of BVP on Riemann Surfaces and Matrix Riemann-Hilbert problems are employed for the proofs. Several recent applications of the above theorems also will be presented.

- **Tuesday, May 18th, 2021**

16:00 – 17:00 **Andrey Bogatyrev (Institute of Numerical Mathematics, Moscow)**

Chebyshev heritage in new Millennium

Abstract:

P.L. Chebyshev was a bright representative of mathematicians who are motivated by real life problems and practical applications of this science. Many of his ideas still allow us to analyze and solve sophisticated rational approximation problems. In this talk we consider several problems stemming from optimization of numerical algorithms and electrical engineering, which were solved on the basement of works of the prominent scholar.

17:00 – 18:00 **Vladimir M. Tikhomirov (Moscow State University)**

will talk about Chebyshev's life and ideas

- informal session for Russian speaking audience

All talks take place at Erwin Schrödinger Institute - virtual via zoom! Zoom coordinates are available on request (secr@esi.ac.at).