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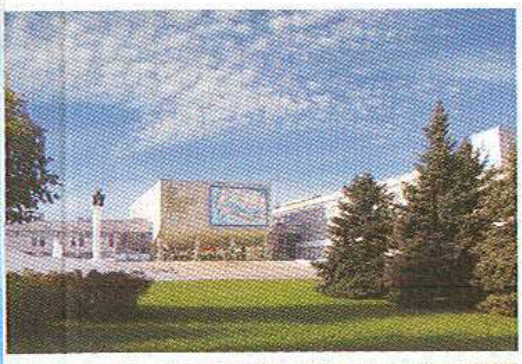

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The programme of the Congress includes the following topics: real, functional, complex analysis, operator theory, theory of ordinary differential equations, theory of partial differential equations, theory of integral equations, nonlinear analysis, optimization theory, variational analysis, approximation theory, applications of analysis (inverse problems, functional and difference equations, mathematics in medicine, stochastic analysis); teaching analysis at universities and schools, history of analysis etc.

Abstracts are published in the form presented by the authors, without further editing.

This volume would be of interest for mathematicians working in all main branches of contemporary mathematical analysis and its applications. Prepared by the Organizing Committee of the 8-th Congress of the ISAAC.

Fast Laguerre projection methods for finite Hankel transform of arbitrary order

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The general scheme of the projection method for solving type I linear equations of $Az = u$ in Hilbert space is based on expanding the solution in a series according to the eigenfunctions of self-adjoint operator A^*A.

The modification of the projection method for the integral equation

$$Az = \int_0^a z(x) J_\alpha(xk) x\, dx = u(k), \quad A : L_2[0,a] \to L_2[0,a], \quad 0 < a < \infty,$$

is presented. The right side is set approximately and $J_\alpha(x)$ is a Bessel function of order α. This modification is called the Laguerre projection method. The main idea of Laguerre projection method is to replace the eigenfunctions corresponding to eigenvalues close to the multiple with Laguerre functions.

The eigenfunctions of Hankel transform ($a = \infty$) of order α are Laguerre functions $\Psi_n^\alpha(x^2) = x^\alpha e^{-x^2/2} L_n^\alpha(x^2)$ where $L_n^\alpha(x) = (x^{-\alpha}e^x/n!)(x^{n+\alpha}e^{-x})^{(n)}$. They form an orthonormal system in $L_2[0,\infty)$. At the same time, from a computational point of view, each of these functions has a finite support. This property allows to replace the eigenfunctions of operator A^*A that corresponds to computationally multiple eigenvalues by Laguerre functions. This operation increase the stability of the solution and accelerates the computation. To use of Laguerre functions instead of the eigenfunctions of A^*A we need to compute the projection coefficients $u_i = \int_0^a u_\delta(k)\Psi_i^\alpha(k)\, dk$. As $\|\Psi_i^\alpha(x)\|_{L_2[a,\infty)}$ norms are close to zero in the case of sufficiently large a, u_i can be approximated $u_i = \int_0^a u_\delta(k)\Psi_i^\alpha(k)\, dk \approx \int_0^\infty u_\delta(k)\Psi_i^\alpha(k)\, dk$.

The fast methods for $\int_0^\infty u_\delta(k)\Psi_i^\alpha(k)\, dk$ integrals computation based on the Gauss–Hermite and Gauss–Laguerre quadratures are investigated.

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