Editors: Nikos Mastorakis, Valeri Mladenov,
Metin Demiralp, Zoran Bojkovic

Applied Mathematics & Informatics

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European Conference for the Applied Mathematics and Informatics

Vouliagmeni, Athens, Greece, December 29-31, 2010

ISSN: 1792-7390
ISBN: 978-960-474-260-8

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All papers of the present volume were peer reviewed by two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.
See also: http://www.worldses.org/review/index.html

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European Society for Applied Mathematics - EuroSAM

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ISBN: 978-960-474-260-8

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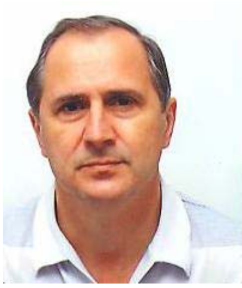
Plenary Lecture 1

Density and Approximation by Radial Basis Functions



Professor Vitaly Maiorov

Abstract: We characterize the radial basis functions whose scattered shifts form a fundamental system in the space $L_p(\mathbb{R}^d)$. In particular, we show that for any even function h from the space $L_2(\mathbb{R}, \mu)$, the space formed by all possible linear combinations of shifted radial functions $h(\|x+a\|)$, $a \in \mathbb{R}^d$, is dense in the space $L_p(\mathbb{R}^d)$, $1 \le p \le 2$, if and only if the function h is not a polynomial. The problems of approximation by radial basis functions also are discussed.

In order to obtain our results we make use of methods of harmonic analysis on the unit ball B^d which are based on a combination of methods of harmonic analysis on the unit sphere $\mathbb{S}^{d-1}$ and the unit segment $\mathbb{U} := [-1, 1]$. Using an orthogonal basis of spherical harmonics on $\mathbb{S}^{d-1}$ and the Gegenbauer basis of orthogonal polynomials on the segment $\mathbb{U}$ we construct a new basis $\mathbf{P} = \{P_n\}$ ('convolution' of bases on $\mathbb{S}^{d-1}$ and on $\mathbb{U}$) consisting of orthogonal polynomials on the ball B^d. The peculiarity of the basis $\mathbf{P}$ is that the moments $M_\alpha(g, a) := \langle g_a, P_n \rangle$ of radial functions of the form $g_a = g(\|x+a\|)$ in some sense allow for a separation of the variables g and a. That is, we represent them by the finite sum $M_\alpha(g, a) = \sum_k u_k(g) v_k(a)$, where $u_k(g)$ are a linear functionals of g and $v_k(a)$ are a functions on $\mathbb{R}^d$.

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Authors Index

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