



Special issue on harmonic analysis, applied mathematics and engineering problems

Pierre Louis Lions ¹, Natasha Samko ², Seenith Sivasundaram ³

* Guest Editors:

¹ Collège-de-France, Paris, France.

² UiT The Arctic University of Norway, Narvik, Norway.

³ College of Science, Engineering and Mathematics, Daytona Beach, FL 2114, USA.

Dedicated to the 75th anniversary of Professor Lars-Erik Persson

Preface

This special issue "Harmonic Analysis, Applied Mathematics and Engineering Problems", dedicated to 75th anniversary of Professor Lars-Erik Persson, contains papers on various topics in pure and ap-

2010 **Mathematics Subject Classification:** 01A99, 11R52; 15A99, 15B51, 26A51, 26A33, 26A70, 26B25, 26D10, 26D15, 26D20, 26E70, 28B25, 34B60, 34C10, 34D20, 34N05, 35J40, 35K55, 35K65, 35Q30, 35Q35, 35Q40, 35S30, 42A16, 42A38, 42A45, 42B15, 42B20, 42B25, 42B35, 42C10, 43A32, 43A50, 44A10, 44A15, 44A35, 45A05, 46B70, 46E20, 46E30, 46E99, 46F05, 46F10, 47A50, 47A63, 47B34, 54C35, 60H30, 76D05, 76D06, 76F02, 76F55, 76S05, 76S99, 94A17, 97M10.

Keywords: harmonic analysis, conceptual harmonic analysis, Fourier analysis, modal analysis, functional analysis, tempered distributions, mild distributions, Hilbert transform, Fourier transform, Segal algebra, Banach ideal, multipliers, Fourier multipliers, partial differential equations, double nonlinear parabolic equations, uniformly higher-order elliptic equations, fractional order partial differential equation, fourth order differential equation, nonlinear coupling, generalized fractional coupled systems, pedestrian flows, Forchheimer flows, stochastic, stochastic closure theory, homogeneous turbulence, boundary turbulence, Lagrangian turbulence, scalings, function spaces, weights, weighted local Morrey-type spaces, weighted Cesàro function spaces, generalized weighted Sobolev-Morrey spaces, grand spaces, Bergman spaces, associated spaces, Lebesgue spaces, Banach function spaces, martingale Hardy spaces, Orlicz spaces, Musielak-Orlicz spaces, Orlicz-Morrey spaces, interpolation theory, inequalities, Hardy-type inequalities, iterated Hardy inequalities, Polya-Knopp's inequality, Carleman's inequality, Hardy-Knopp's inequality, Carleson's inequality, refined inequalities, Jensen inequalities, Jensen-Steffensen inequalities, Hermite-Hadamard inequalities, Fejér inequalities, weighted inequality, convexity, extension, oscillation, non-oscillation, Phi-function, finitely supported function, superquadratic functions, convex functions, quasilinear operator, bilinear operator, singular integral operators, Jacobi polynomials, applied mathematics, approximate solutions, error analysis, rigid-body modeling, dynamics, control, variational principle, structural, monitoring, sub-space identification, frequency domain decomposition, damage detection, civil engineering structures, artificial intelligence, arctic conditions, a priori estimates, growth estimate, Vilenkin systems, strong convergence, double Walsh-Fourier series, spherical partial sums, convergence in measure, wavelet, Clifford analysis.

On the one hand, new important achievements in functional analysis lead to progress in the theory of differential equations as mathematical models in applied sciences and thus to a way to applications. On the other hand, the problems of physics and natural sciences formulated in the language of differential equations give rise to new directions in functional analysis and lead to the need to improve it giving in its turn rise to new theoretical breakthroughs.

The variety of different topics in this issue is not occasional, being motivated by the fact that Professor Lars-Erik Persson contributed in his research to various fields of pure and applied mathematics. The reader can find a presentation of Professor Lars-Erik Persson's scientific activities in the opening article of this issue „Lars-Erik Persson - the remarkably broad and innovative mathematician and unique Pers(s)on”, by Dag Lukkassen and Annette Meidell.

It is worth mentioning that Professor Persson's affiliation with Luleå University of Technology, with which he was associated until 2018, made this university known in the world mathematical circles. It is also well known that Lars-Erik Persson together with his PhD students Nils Svanstedt and Dag Lukkassen were in fact pioneers in the research in such a field of applied mathematics as the homogenization theory, in particular in the theory of Cauchy media.

The increasing complexity of the mathematical models in applications requires more advanced mathematical tools. This encourages researchers to look for new dependencies and/or descriptions in the mathematical models of the phenomena under the study that could lead to a refinement of the model.

It is well known that the modern research in applied sciences is profoundly intertwined with such areas of pure mathematics as functional analysis, operator theory and harmonic analysis. Thus, methods and results of these areas are fundamental tools in study of variety of applied problems in mechanics, homogeneous linear theory, differential equations and some applied sciences.

Piled mathematics including, in particular, such areas as harmonic analysis, function spaces, inequalities,

The issue opens with a short expository paper about Lars-Erik Persson [1]. The topics presented in this issue are related to harmonic analysis, applied mathematics, engineering problems, etc. In the course of its study, one naturally feels the need for studying mathematical techniques in various engineering and allied fields. Some are invited papers. The following studies are presented in this issue: superquadratic approach for refinement of one-dimensional and multi-dimensional inequalities [2], Shoshana Abramovich, oscillation and non-oscillation properties of solutions to fourth order differential equations [3], Alimaga Alidiyeva and Ryskul Oinarov, Carleson- and Hardy-type inequalities in the Banach function space setting [4], Sotima Barza and Lurdilla Niklova, stochastic closure theory of turbulence problems and the Kolmogorov-Oubkova scaling theory [5], Björn Birnir, development of an approach showing the significance of mild distributions in Fourier analysis [6], Hans G. Feichtinger, embedding problems for weighted local Morrey-type spaces [7], Amiran Gogatishvili and Tigran Ogonyan, characterization of convergent spherical partial sums of double Walsh-Fourier series [8], Ushangi Goginava, higher order elliptic equations in generalized weighted Sobolev-Morrey spaces [9], Vagif Guliyev, Tahir Gadjiev and Ayyam Serbetci, consistent theories of truth for languages which conform to classical logic [10], Seppo Heikkilä, extension problems for Young-type functions generating Musielak-Orlicz function spaces [11], Peter Hästö, dual quasimotion based motion control problems [12], Tor-Aleksander Johansen, José J. Corona Sanchez and Raymond Kristiansen, singular integral operators acting on Orlicz-Morrey spaces of the first kind [13], Yoshihiro Sawano, recent trends in operation modal analysis techniques and its application on a steel truss bridge [14], Harpal

Singh and Niklas Grip], studies on continuous dependence solutions for pantograph equations with ψ -Hilfer fractional derivative [15, D. Vivek, Siva Sivasundaram and K. Kanagarajan], bilinear Hardy-type inequalities in weighted Lebesgue spaces [16, Vladimir Stepanov and Elena Ushakova], numerical methods for a generalized class of fractional order partial differential equations [17, Imran Talib, Fethi Bin Muhammad Belgacem, Hammad Khalil and Cemil Tunc], convergence and strong summability of the two-dimensional Vilenkin-Fourier series in the martingale Hardy spaces [18, George Tephnadze], weak solvability for a nonlinear coupled parabolic system that models the evolution of a complex pedestrian flow [19, T.K. Thoa Thieu, Matteo Colangeli and Adrian Muntean], estimates of growth of analytic functions near the boundary in the grand Bergman and it's associated space, on the upper half-plane [20, Salaudin Umakhdzhiev], variable exponent Hardy spaces with applications to Fejér summability of Walsh-Fourier series [21, Ferenc Weisz], determining the basins of convergence in the Sitnikov three-body problem with a repulsive quasi-homogeneous Manev-type potential [22, Euaggelos E. Zotos, Md Sanam Suraj, Amit Mittal and Rajiv Aggarwal].

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