Mathematical Institute of the Serbian Academy of Sciences and Arts
Computer Science and Applied Mathematics Colloquium
Seminar on Computer Science and Applied Mathematics
Seminar for the History and Philosophy of Mathematics, Mechanics and Astronomy

Tuesday, November 13, from 11 am to 2 pm
Hall 2 of the Serbian Academy of Sciences and Arts

Scientific conference dedicated to the 70th birthday of academician Gradimir V. Milovanović

PROGRAM

11:00-11:30 Stevan Pilipović, Faculty of Sciences, University of Novi Sad
A JOINT JOURNEY THROUGH MATHEMATICS IN SERBIA - introductory talk

11:30-12:00 Miodrag Mateljević, Faculty of Mathematics, University of Belgrade
INTERIOR ESTIMATE FOR ELLIPTIC PDE, QUASICONFORMAL AND HQC MAPPINGS BETWEEN LYAPUNOV JORDAN DOMAINS

Abstract: We prove that if h is a quasiconformal (shortly qc) mapping of the unit disk $\mathbb{U}$ on Lyapynov domain, then it maps subdomains of Lyapynov type of $\mathbb{U}$, which touch the boundary of $\mathbb{U}$, onto domains of similar type. We can regard this result as "good local approximation of qc mapping h by its restriction to a special Lyapunov domain so that codomain is "locally convex". In particular if h is a hqc (harmonic qc) mapping of $\mathbb{U}$ onto Lyapynov domain, using it, we prove that h is co-Lip on $\mathbb{U}$. It settles an open intriguing problem in the subject and can be regarded as a version of Kellogg-Warschawski theorem for hqc.

12:00-12:30 Marija P. Stanić, Faculty of Sciences, University of Kragujevac
MULTIPLE ORTHOGONAL POLYNOMIALS ON THE SEMICIRCLE

Abstract: In this talk two types of multiple orthogonal polynomials on the semicircle with respect to a set of r different weight functions are considered. Such polynomials are generalizations of polynomials orthogonal on the semicircle with respect to a complex–valued inner product

$$[f, g] = \int_0^\pi f\left(\mathrm{e}^{\mathrm{i}\theta}\right) g\left(\mathrm{e}^{\mathrm{i}\theta}\right) w\left(\mathrm{e}^{\mathrm{i}\theta}\right) \,\mathrm{d}\theta.$$

We present conditions for weight functions which ensure the existence and uniqueness of such multiple orthogonal polynomials. Also, some properties of multiple orthogonal polynomials on the semicircle including certain recurrence relations of order $r+1$ are presented. Finally, an application in numerical integration is given.

12:30-13:00 P. Stanimirović, Faculty of Sciences and Mathematics, University of Niš

SOME RESULTS ABOUT NONLINEAR OPTIMIZATION AND SYMBOLIC COMPUTATION

Abstract: Various variants of accelerated gradient descent methods for solving nonlinear unconstrained optimization problem are investigated. Particularly, double step size and double directions algorithms, proposed in [2, 3, 5, 6], are considered. In addition, two improvements of gradient descent iterative methods for solving unconstrained optimization are proposed. The first modification is based on a small enlargement of the step size in accelerated gradient descent methods. The second improvement is defined upon a hybridization of accelerated gradient descent methods with the Picard-Mann-Ishikawa iterative process. The proposed methods are proven to be linearly convergent for uniformly convex functions and also, under some specific conditions, linearly convergent for strictly convex quadratic functions.

The monograph [4] aims to describe the basic possibilities of the *Mathematica* software package as well as its applications in many mathematical fields. Accordingly, the monograph is divided into two parts. The first chapter contains a description of the *Mathematica* software package, with the aim to describe *Mathematica* as a programming language. The second chapter describes symbolic implementation of a number of mathematical problems, such as: sorting algorithms, multiple use of a functional argument, backtracking, some applications of linear programming, multi-criteria optimization, automatic proving of some statements in Boolean algebra, location and network problems, unary par-functions.

The main goal of the monograph [1] is symbolic implementation of the basic nonlinear programming methods. Both unconstrained and constrained nonlinear optimization methods have been worked out. The implementation of gradient and non-gradient optimization methods as well as the implementation of global optimization is described.

References

[1] G.V. Milovanović, P.S. Stanimirović, *Simbolička implementacija nelinearne optimizacije*, Elektronski fakultet u Nišu, Edicija monografije, Niš, 2002, X+236 (ISBN 86-80135-67-4).

[2] M.J. Petrović, P.S. Stanimirović, *Accelerated Double Direction method for solving unconstrained optimization problems*, Mathematical Problems in Engineering, Volume 2014, http://dx.doi.org/10.1155/2014/965104

[3] M.J. Petrović, *An Accelerated Double Step Size model in unconstrained optimization*, Appl. Math. Comput. **250** (2015), 309–319.

[4] P.S. Stanimirović, G.V. Milovanović, *Programski paket MATHEMATICA i primene*, Elektronski fakultet u Nišu, Edicija monografije, Niš, 2002, XII+242 (ISBN 86-80135-68-2).

[5] P.S. Stanimirović, M.B. Miladinović, *Accelerated gradient descent methods with line search*, Numer. Algor. **54** (2010), 503–520.

[6] P.S. Stanimirović, G,V. Milovanović, M.J. Petrović, N. Kontrec, *Transformation of accelerated double step size method for unconstrained optimization*, Math. Probl. Eng., vol. 2015, Article ID 283679, 8 pages, 2015. doi:10.1155/2015/283679.

13:00-13:30 Miodrag M. Spalević, Faculty of Mechanical Engineering, University of Belgrade
QUADRATURES WITH MULTIPLE NODES FOR FOURIER COEFFICIENT

Abstract: Gaussian quadrature formulas with multiple nodes and their optimal extensions for computing the Fourier coefficients, in expansions of functions with respect to a given system of orthogonal polynomials, are considered. A numerically stable construction of these quadratures is proposed. Error bounds for these quadrature formulas are derived. We present a survey of recent results on this topic.

13:30-14:00 Gradimir V. Milovanović, Mathematical Institute Serbian Academy of Sciences and Arts
Dragan Pavlović, School of Electrical Engineering, University of Belgrade
NUMERICAL METHODS FOR VOLTERRA INTEGRAL EQUATION IN THE CALCULATION OF THE CHANNEL DISCHARGE FUNCTION

Abstract: We consider a highly accurate and extremely efficient method for solving a special Volterra integral equations of convolution type which appear in the calculation of of the channel discharge function in the so-calledgeneralized lightning traveling current source return stroke model. Calculating the channel discharge function opens the way to many calculations in the physics of electrical discharges and power engineering. A comparison withthe Laplace transform method, which needs a numerical inversion of the Meijer G-functions, is also given.

14:00 **COCKTAIL**