

Orthogonal Polynomials and Special Functions

SIAM Activity Group on Orthogonal Polynomials and Special Functions

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Newsletter

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OP-SF Net. We hope you find this issue interesting and useful, and remind you that you can send items for future issues to either of us.

February 1, 2000

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Research Perspectives

As a follow-up to the Honk Kong panel discussion [see the Newsletter Vol. 10, Number 1, October 1999] the SIAM activity group will maintain a list of “research perspectives” on the web. The activity group homepage will soon contain a link to a list of possible directions in research relevant for (young) people interested in our field. This link will be coordinated by Walter Van Assche. Please remember to send possible suggestions and items for inclusions to walter@wis.kuleuven.ac.be

Walter Van Assche
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From the Editors

This is the first issue of the Newsletter for 2000, the World Mathematical Year. In this issue we include a new section containing OP-SF-related preprints appearing in the **xxx** archive. As usual, a great deal of material comes from the

Reports from Meetings and Conferences

1. Fifth International Symposium on Orthogonal Polynomials, Special Functions and their Applications (OPSFA) in Honor of Theodore Chihara: Patras, September 20-24, 1999

————— SIAM Activity Group —————
 on
 Orthogonal Polynomials and Special Functions



Elected Officers

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WALTER VAN ASSCHE, *Vice Chair*

FRANCISCO MARCELLÁN, *Program Director*

CHARLES DUNKL, *Secretary*

Appointed Officers

RENATO ÁLVAREZ-NODARSE, *Co-Editor of the
 Newsletter*

RAFAEL J. YÁÑEZ, *Co-Editor of the Newsletter*

MARTIN E. MULDOON, *Webmaster*



THE PURPOSE of the Activity Group is

—to promote basic research in orthogonal polynomials and special functions; to further the application of this subject in other parts of mathematics, and in science and industry; and to encourage and support the exchange of information, ideas, and techniques between workers in this field, and other mathematicians and scientists.

The Fifth International Symposium on Orthogonal Polynomials, Special Functions and their Applications (OPSFA, for short), was held in Patras, Greece, September 20 - 24, 1999. This was a conference in a European series including Bar-Le-Duc (1984), Segovia (1986), Erice (1990), Granada (1991, VII SPOA), Evian (1992), Delft (1994, Stieltjes centenary) and Seville (1997, VIII SPOA); it certainly lived up to reputation of that series for the excellence of the program and organization.

The Symposium was dedicated to Professor Ted Chihara in honour of his many contributions to the subject of Orthogonal Polynomials. In fact the opening ceremony consisted of a presentation to Chihara, a talk on his work by Walter Van Assche and a characteristically modest lecture by Ted entitled "Orthogonal Polynomials - a view from the wings". There was a very full programme of plenary and contributed talks.

The main events were held in a new building at the magnificently located University of Patras, the participants being bussed from nearby hotels to the sessions and to the extensive program of social events. Though Thursday was announced as a "Greek evening" (with respect to food and entertainment) but it was quickly observed by the participants that every evening could be so characterized. The local organizers themselves set a great example for singing

and dancing and succeeded in drawing in all participants.

The proceedings of the Symposium will appear as a special volume of the *Journal of Computational and Applied Mathematics*. The proceedings volume is expected to include a report on a session for open problems which concluded the symposium.

The next meeting in the European series on Orthogonal Polynomials will be held in Italy in 2001, possibly in late June though the location and exact dates have not been determined. The contact person is Andrea Laforgia (laforgia@dma.uniroma3.it).

Martin Muldoon
 (muldoon@yorku.ca)

September 20–24, 1999, the city of Patra (Greece, approximately 200 kilometers West from Athens), hosted the "Fifth International Symposium on Orthogonal Polynomials, Special Functions and their Applications".

The local organizing committee consisting of Evangelos Ifantis, Chrysoula Kokologiannaki and Panayiotis Siafarikas succeeded, with the aid of Eugenia N. Petropoulou and Kiriaki Vlachou to set a standard of both scientific and social level that will be difficult to better.

On one hand the scientific program with plenary lectures in the morning, followed by research seminars in parallel sessions and the social program on the other hand showed unexpected talents of many a participant.

Central was the guided visit to the ancient city of Olympia: history looked over our shoulders to see how the mathematicians of today shape the history of tomorrow. And each day the recurrent happening of the evening meal that should be called a *social gathering*.

There it became clear that not only mathematics linked the participants together, but also the intricacies of the *links and braids* of the steps of the Greek dance. Greek music united many and succeeded in loosening up a community that is usually considered *stuffy* by the outside world.

Other documents will give an account of the main mathematical achievements. I can only say that this was a superbly organised conference and conclude this with a well meant *Ευχαριστω πολυ*

Marcel de Bruin
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The Fifth International Symposium on Orthogonal Polynomials, Special Functions and their Applications which took place in Patras, Greece, from September 20 to 24, 1999, is the most recent of a series of primarily European conferences focused on these questions. It is inspiring to see how the fields of orthogonal polynomials and special functions have grown since the first of these series of meetings in Bar-Le-Duc in 1984. Over 160 mathematicians from 33 countries arrived in the provincial University of Patras

in the middle of the semester to participate in one of the most intense and cosmopolitan scientific meetings I have ever attended. A field of mathematics that once was the special interest of a few specialists in Northern Europe, is now flourishing in Spain, Italy, Portugal, and Greece. It was also heartening to see that the large number of mathematicians from the Maghreb in attendance. If Ferdinand Braudel was writing his great book “La Méditerranée et le Monde Méditerranéen...” today, he would have to include a chapter on the study of orthogonal polynomials as one of the great unifying trans-cultural themes of the Mediterranean basin.

The daily schedule included talks from 9:00 am to 1:30 pm, a two hour break for lunch, and then more talks from 3:30 to 7:00 pm. After the talks, the very energetic organizers took us off to visit some great ruin, and then about the time I was longing for bed, we would begin dinner (usually around 10:00 pm). After dinner the bouzouki music began and there was general dancing led by our Greek colleagues who are stronger human beings than I. We would go to bed at 1:00 am, and then start over the next day. By the fourth day of the conference there were middle aged mathematicians leaning against olive trees all over the lovely campus producing gentle snoring sounds. The most impressive single event in the social program was our visit to Olympus, where Walter van Assche was challenged to a foot race in the Olympic stadium by his student Els Coussement. Age triumphed over youth and beauty! Walter was rewarded for his Olympian efforts with the presentation of the traditional wreath of laurels on the last day of the conference.

The conference honored the work of Ted Chihara, and our newest Olympian (van Assche) gave an overview of Chihara’s many accomplishments in the opening session. Then Professor Chihara responded with his typical modesty, and gave a very personal, and delightful interpretation of the developments in orthogonal polynomials over the last half century. There were eight other plenary lectures, and over one hundred research seminars, so it is impossible to give anything but a very personal, selective, and impressionistic description of the many fine papers. The plenary lecture that I was most interested in was Lance Littlejohn’s presentation of his and Norrie Everitt’s progress on the “Ericc Conjecture”. These results are part of the effort to develop a complete theory of multivariate orthogonal polynomials that are the eigenfunctions of differential operators. Walter Gautschi gave a magisterial overview of the problems that occur when polynomials are used for quadrature when there is a pole near the interval of integration. The lecture of Arno Kuijlaars was a personal revelation, since I knew very little about the asymptotics of polynomials orthogonal with respect to Freud weights, and Kuijlaars’ elegant presentation made this corner come alive for me.

I must be even more selective in discussing the research

seminars. Nico Temme gave a very clear talk about obtaining the asymptotics for certain polynomials in the Askey scheme as limits of the asymptotics of other polynomials in that scheme that we already understand. Kathy Driver gave a provocative and delightful report on where the zeros of the ultraspherical polynomials go when the parameter is allowed to be less than minus one half. Wojciech Mlotkowski reported on some joint work with Ryszard Szwarc. They have found a new and very clever way to prove the non-negativity of the linearization coefficients for polynomials supported on discrete measures. And finally, the last talk on the last day of the conference, when the participants were near mental and physical exhaustion, the members of the organizing committee (Ifantis, Kokologiannaki, and Siafarikas) presented a very nice sufficient condition for the support of the orthogonality measure of a family of polynomials to be the entire interval. I was tired. They must have been near collapse. What a display of “paidea”.

I came to Greece not knowing what to expect. I was awed by the science, the land, and the people. To paraphrase Alan Bates’s line at the end of that famous movie, “Panos, Chrysoula, Teach me to dance!”

William Connett
(connett@arch.umsl.edu)

2. Conference on Analytic Methods of Analysis and Differential Equations, Minsk, Belarus, September 14-18, 1999

The international conference “Analytic Methods of Analysis and Differential Equations” (AMADE) took place September 14-18, 1999 in Minsk, Belarus. It was organized by the Belarusian State University, the Belarusian National Academy of Sciences together with Moscow State University and the Computer Center of the Russian Academy of Sciences. It was held at the Olympic Sport Center “Staiki” which is situated 10 km from Minsk, the capital of Belarus.

More than 320 mathematicians confirmed their interest in the Conference. Abstracts of their reports were published in *Abstracts of AMADE*. 165 scientists from Algeria, Australia, Belarus, France, Germany, Great Britain, Italy, Japan, Korea, Lithuania, Poland, Portugal, Russia, Spain, Ukraine and USA took part in AMADE.

There were 18 plenary invited lectures and 93 sectional talks on various modern problems of integral transforms, special functions, differential equations, operator theory, approximation and fractional calculus.

Plenary invited lectures were given by the following mathematicians:

- Burenkov, V.I. (Great Britain): Extension theo-

rems for spaces of differentiable functions defined on strongly degenerated domains.

- Gaishun, I.V. (Belarus): Canonical forms of linear nonstationary system of equations and their applications.
- Glaeske, H.-J. (Germany), together with Saigo, M. (Japan): On a hybrid Laguerre Fourier transforms.
- Grebennikov, E.A. (Russia), together with Kozak, D., and Yakubyak, M. (Poland): KAM-theory and stability of homographic solutions of Hamiltonian systems of cosmic dynamics.
- Gromak, V.I. (Belarus): Isodromic deformation of linear systems and of p-type equations.
- Karapetyants, N.K.(Russia): On a fredholmness of a class of Hankel operators.
- Kilbas, A.A. (Belarus): Integral and differential equations of fractional order. Theory and applications.
- Korzyuk, V.I. (Belarus): Conjugation problems for differential equations with integro-differential conditions.
- Kun Soo Chang (Korea): Analytic Fourier-Feynman transform and convolution of functionals on abstract Wiener space.
- Laurinchikas, A. (Lithuania) - The Lerch zeta function.
- Lebedev, A.V., together with Antonevich, A.B. and Bakhtin, V.I. (Belarus): Variational principle for spectral radius.
- Love, E.R. (Australia): Fourier-style expansions in series of general Legendre functions.
- Marichev, O.I., together with Trott, M. and Adamchik, V.S. (USA): The mathematical functions in Mathematica.
- Mitjushev, V.V. (Poland), together with Adler, P. (France): Boundary value problems in a class of doubly periodic functions and their applications in porous media.
- Nakhushhev, A.M., together with Nakhusheva, V.A. (Russia): On some differential equations of fractional order and their applications.
- Rogosin, S.V.(Belarus), together with Reissig, M.(Germany): Complex Hele-Shaw model with linear and nonlinear kinetic undercooling regularization.
- Saitoh, S.(Japan): Various integral operators induced by integral transforms.

- Yurchuk, N.I.(Belarus): Regularization by nonlocal conditions of the incorrect problems for the differential operator equations.

The 93 sectional talks were distributed as follows: Integral Transforms and Special Functions (14); Ordinary Differential equations (13); Partial Differential Equations (13); Different Aspects of Function Theory (12); Applications of Differential Equations and Function Theory (15); Integral and Functional Equations and Applications (13); Operator Theory (13).

It is hoped that the Proceedings of AMADE will be published in *Proceedings of Institute of Mathematics* of the Belarusian National Academy of Sciences. Some of the reports will be published in a special issue of *Integral Transforms and Special Functions*, dedicated to Professor Anatolii Platonovich Prudnikov (Russia) who was one of the main founders of AMADE. Though his sudden death on January 10, 1999 was a big tragedy, participants at the Conference honored his memory in their reports.

Sergei Rogosin
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3. Workshop on Contemporary Problems in Mathematical Physics, Institut de Mathématiques et de Sciences Physique (IMSP), Cotonou, République du Bénin (Africa), October 31st - November 7th, 1999.

The *First International Workshop on Contemporary Problems in Mathematical Physics*, held in Cotonou, République de BENIN from Oct 31st to Nov 7th, 1999.

About 100 participants from Africa, Europe and North America attended this Workshop organized by the IMSP (Institut de Mathématiques et Sciences Physiques in Porto-Novo, BENIN). Presentations included invited 50-minute plenary talks (21), and 20-minute communications (36).

The following topics were covered in parallel sessions: Coherent states, wavelets and geometric methods in theoretical physics. Quantum field theory, atomic and molecular physics, Operator theory and orthogonal polynomials. Being involved only in the last topic I can say that the Operator theory part was devoted mainly to PDE and Integral operators, presented more or less in the French tradition (Sobolev spaces, numerical approximations etc.,...) but sometimes applied to African needs. For instance, regulation of dams on the Senegal river and transport problems in the Oueme river (Benin) motivated sophisticated simulations with control theory coupled with fluid mechanics. Three Lectures on Classical Orthogonal Polynomials (available on request) were given by the author of this report, and other communications dealt with some semi-classical families (generalized Charlier and Meixner),

Laguerre-Freud equations, Laguerre-Hahn class and numerical integration. During the last day participants also had the opportunity to attend an International Conference on Interuniversity Cooperation, under the auspices of UNESCO.

We appreciated the efforts of the organizers to ensure the comfort of all participants, and the relaxing outdoor discussions between lectures among wonderful trees and flowers. Several banquets, receptions and excursions also succeeded in creating a friendly ambience for which we are indebted to the organizers. The proceedings will be published by World Scientific (Editors: J. Govaerts, N. M. Hounkonnou and W. A. Lester, Jr) and the second Workshop is already planned, again in Cotonou, in November 2001.

André Ronveaux
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Forthcoming Meetings and Conferences

1. Workshop on Quantum Groups, Morelia, Mexico, March 27-31, 2000

This information is taken from the web site: <http://msri.org/activities/events/9900/qgroups/>

Organizing Committee: Susan Montgomery (USC), Jose Antonio de la Pena (UNAM), Claudio Procesi (U. of Roma), and Nicolai Reshetikhin (UCB).

Quantum groups emerged from mathematical physics in mid 80's as an algebraic structure hidden behind quantum integrable systems. Algebraically quantum groups are Hopf algebras which are noncommutative deformations of functions on Lie groups, or dualizing, non-commutative deformations of universal enveloping algebras of Lie algebras. Immediately after these structures were discovered they were used to construct new invariants of knots and 3-manifolds.

One of the most important discoveries in representation theory in the 90's was the universal (crystal) basis discovered by Kashiwara and Lusztig, discovered using quantum groups, and more recently, Nakagima and others constructed representations of affine Lie algebras and corresponding quantum groups using geometry of certain moduli spaces. Another area where quantum groups clarified a lot the existing results and made possible fast progress in the theory of special functions (q -special functions). Conceptually, this direction can be regarded as harmonic analysis on quantum groups. Yet another direction emerged from study of the study of Hopf algebras with real structure by means of functional analysis. This direction, is well represented in the community of people working in C^* -algebras.

Topics to be covered in the conference are as follows:

- Finite dimensional Hopf algebras
- Geometric realizations of quantized universal enveloping algebras
- Applications of quantum groups
- Representation theory of quantum groups

This workshop will be held March 27-31, 2000 in Morelia, Mexico. A proposal for funding has been submitted jointly to the NSF and CONACyT. It is anticipated that there will be approximately 70 participants, half of whom are NSF supported, and the others supported by CONACyT. Preference will be given to recent PhD's and graduate students.

For more information: Communications about this workshop should be sent either by email to qgroups@msri.org or by regular mail to:

Quantum Groups Mathematical Sciences Research Institute
1000 Centennial Drive Berkeley, CA 94720-5070.

Martin Muldoon
(muldoon@yorku.ca)

2. Conference on Reproducing Kernel Hilbert Spaces. Krakow, Poland, April 2000

The long maturing idea of organizing a conference in Krakow to commemorate the 90th anniversary of introducing the reproducing kernel property by Stanislaw Zaremba has become a reality. Now I can announce the conference is going to be in April 2000, from the 16th till the 21st. The aim is to gather people who work in areas to which RKHS pertains, such as, function theory, differential equations, operator theory or probability, to mention only a few (even so abstract domain as operator algebras is not free of it: the famous GNS construction can be viewed as an application of this property).

The first announcement will appear towards the end of January 2000 and will be distributed by email. You can express your interest by sending an email to rkhs2000@im.uj.edu.pl

Franek Szafraniec
(fhszafra@im.uj.edu.pl)

3. Third Workshop Orthogonal Polynomials: Approximation and Harmonic Analysis Inzell, Germany, April 14-18, 2000

The third Workshop on Orthogonal Polynomials will focus on approximation theoretic methods and the relationship to abstract harmonic analysis. The Workshop will take place at Inzell located in the Alps southeast of Munich. The following plenary speakers have accepted so far: P. Butzer (Aachen); W. Freeden (Kaiserslautern); M. Ismail (Tampa); F. Marcellán (Madrid); G. Mastroianni (Potenza); L. Reichel (Kent); H. Stahl (Berlin); V. Totik (Szeged); W. Van Assche (Leuven). For more information consult the homepage of the workshop.

Language: English

Organizing Committee: S. Ehrich, F. Filbir, R. Girgensohn, R. Lasser, J. Obermaier, J. Prestin

Mailing Address:

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Jürgen Prestin
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4. Symposium on Trends in Approximation Theory. Vanderbilt University, Nashville, Tennessee on May 17-20, 2000.

An International Symposium Celebrating the 60th Birthday of Larry L. Schumaker will be held in connection with the 15th annual Shanks Lecture at Vanderbilt University, Nashville, Tennessee on May 17-20, 2000.

The Plenary Speakers are:

1. Charles Chui (Stanford, USA)
2. Zbigniew Ciesielski (Sopot, Poland)
3. Ron DeVore (Columbia, USA)
4. Nira Dyn (Tel-Aviv, Israel)
5. Manfred von Golitschek (Wuerzburg, Germany)
6. Jacob Korevaar (Amsterdam, The Netherlands)
7. George G. Lorentz (Chico, USA) - Shanks Lecturer
8. Sergej Mikhajlovich Nikol'skii (Moscow, Russia)
9. Richard Varga (Kent, USA)

Contributed Talks: We invite you to contribute a talk in any area of approximation theory and its applications (**deadline for registration is April 15, 2000**). The duration of contributed talks will depend on the number of participants and will be announced later.

Symposium Topics: The topics of interest include, but are not limited to:

1. Abstract approximation
2. Approximation with constraints
3. Classical approximation
4. Complex approximation
5. Extremal problems
6. Interpolation and smoothing
7. Curves and surfaces
8. Multiresolution analysis
9. Nonlinear approximation
10. Orthogonal polynomials
11. Radial basis functions
12. Shift-invariant spaces
13. Splines
14. Subdivision and refinable functions
15. Image and signal processing
16. Wavelets

Proceedings: We expect to publish a proceedings containing survey papers by the invited speakers and refereed contributed papers.

Financial Support: We are currently applying for funding to be able to partially support the expenses of graduate students and other mathematicians without support.

Organizing Committee: Kirill Kopotun (Vanderbilt University, USA) Tom Lyche (University of Oslo, Norway) Mike Neamtu (Vanderbilt University, USA)

Address:

e-mail: at@math.vanderbilt.edu

Symposium Address
Trends in Approximation Theory 2000
Department of Mathematics
Vanderbilt University
1326 Stevenson Center
Nashville, TN 37240
USA

More information is available at the Symposium Web site: <http://www.math.vanderbilt.edu/~at/>

Martin Muldoon
(muldoon@yorku.ca)

5. VIIIth International Kravchuk Conference. Kiev, Ukraine, May 11-13, 2000.

The VIII International Conference devoted to the memory of Academician M. Krawtchouk (or Kravchuk) (1892-1942) will be held May 11-13, 2000, in Kyiv (Kiev), Ukraine. It is sponsored by the National Technical University of Ukraine (KPI), the Institute of Mathematics of the Ukrainian National Academy of Sciences, the National Taras Shevchenko University, and the National Dragomanov Pedagogical University.

Programme sections:

1. differential and integral equations, their applications
2. algebra, geometry, mathematical and numerical analysis
3. history of probability and mathematical statistics,
4. history, methods of teaching of mathematics

Contact person:

Prof. Nina Virchenko (KPI)
Tel: +380 44 441 14 41
e-mail: syta@imath.kyiv.ua, random@imath.kyiv.ua
(there is a \$50 registration fee for foreign attendees),
abstract deadline is 1 March 2000.

Conference Web page: http://www.isir.minsk.by/~zelenkov/phymath/kr_polyn/conf8.html

Charles F. Dunkl
(cfd5z@virginia.edu)

6. NATO Advanced Study Institute "Special Functions 2000: Current Perspective and Future Directions", Arizona State University, Tempe, Arizona, U.S.A., May 29 to June 9, 2000

This is an updated version of the announcement in Newsletter Vol 10 Number 2. We emphasize the early deadline February 21, 2000 for application for financial support. The application form is at the website: <http://math.la.asu.edu/~sf2000/>

The reason for the deadline is that the organizers have to submit a list of participants to NATO at an early date in order to get funding. Applications are especially welcome from graduate students and young researchers.

Objective of the ASI: to summarize results in special functions and their diverse applications obtained over the last 3 decades, and to discuss future directions.

Topics: Orthogonal polynomials and special functions in one and several variables, asymptotics, continued fractions, applications to number theory, combinatorics and mathematical physics, integrable systems, harmonic analysis and quantum groups, Painleve classification, and others.

International Organizing Committee: Sergei Suslov, Director from NATO country, Arizona State University, U.S.A.; Vyacheslav Spiridonov, Director from Partner country, Joint Institute for Nuclear Research, Dubna, Russia; Tom Koornwinder, KdV Institute, University of Amsterdam, The Netherlands; Luc Vinet, McGill University, Montreal, Canada.

Local Organizing Committee: Joaquin Bustoz, Chair, Arizona State University; Mourad Ismail, University of South Florida; Sergei Suslov, Arizona State University.

Lecturers: G. Andrews, Pennsylvania State University, U.S.A.; R. Askey, University of Wisconsin, Madison, U.S.A.; P. Deift, Courant Institute, U.S.A.; C. Dunkl, University of Virginia, U.S.A.; A. Grünbaum, University of California, Berkeley, U.S.A.; M.E.H. Ismail, University of South Florida, Tampa, U.S.A.; A. Its, Indiana University - Purdue University, Indianapolis, U.S.A.; E. Koelink, Technische Universiteit Delft, The Netherlands; T. Koornwinder, KdV Institute, University of Amsterdam, The Netherlands; I. Macdonald, Queen Mary College, London, England (not confirmed); S. Milne, The Ohio State University, U.S.A.; O. Njåstad, Norwegian University of Science & Technology, Norway; M. Rahman, Carleton University, Ottawa, Canada; V. Spiridonov, Joint Institute of Nuclear Research, Dubna, Russia; D. Stanton, University of Minnesota, U.S.A.; S. K. Suslov, Arizona State University, U.S.A.; N. Temme, CWI, Amsterdam, The Netherlands; V. N. Tolstoi, Moscow State University, Russia; L. Vinet, McGill University, Montreal, Canada; A. Zhedanov, Donetsk Institute for Physics and Technology, Ukraine.

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Sergei Suslov
 (sks@asu.edu)

7. Alhambra 2000: A joint Mathematical European-Arabic Conference. Granada, July 3rd to 7th, 2000

PRELIMINARY ANNOUNCEMENT

The ALHAMBRA 2000 JOINT MATHEMATICAL EUROPEAN-ARABIC CONFERENCE arises within European Mathematical Society (EMS) as an opportunity of a meeting between mathematicians from every European-Arabic culture. Granada, with the Alhambra as an ensign, accepts this challenge of promoting a meeting between scientists of the three Mediterranean cultures, which is to be held at the same time to commemorate the year 2000 as the World Year of Mathematics.

The Spanish Royal Mathematical Society, integrated in the EMS since 1998, offers support and heads the organization of this encounter in Granada. ALHAMBRA 2000 is already going to become a reality.

ALHAMBRA 2000 is an acknowledged satellite activity of the 3rd European Congress of Mathematics, Barcelona, July 10th to 14th.

Structure: The ALHAMBRA 2000 Conference includes:

- The ALHAMBRA 2000 European-Arabic Congress of Mathematics that will deal with historical perspectives on contributions of both cultures to the present mathematical knowledge, and also will discuss about the state of the more relevant mathematical concepts over the centuries and the way they have evolved. Plenary lectures of the above subjects will be held in morning sessions, and short communications will be held.
- Eight ALHAMBRA 2000 Symposia on current mathematical subjects to be held in afternoon parallel sessions. The Symposia serve as platforms for the presentation and discussion of the state of the art of topics in the list of scientific topics below, and they include lectures as well as short communications, either spoken or in the form of posters.

List of Scientific Topics:

1. Computational mathematics

2. Geometry of submanifolds
3. Non-linear problems
4. Orthogonal polynomials
5. Public mathematics
6. Representation theory of algebras
7. Symmetry

Registration: The registration deadline is June 2, 2000. For more information about prices, hotels, etc., see the WWW page <http://www.ugr.es/~alhambra2000/register.htm>.

For further information please contact with the conference secretariat:

ALHAMBRA 2000 Conference
 eurocongres Avda. Constitución, 18 - Blq.4 E-18012 - GRANADA, SPAIN Voice: +34 958 209 361 Fax: +34 958 209 400 E-mail: eurocongres@mx3.redestb.es

Local organisation committee:

E-mail: alhambra2000@ugr.es
 Web: <http://www.ugr.es/local/alhambra2000>

For further information about the ALHAMBRA 2000 Symposium on Orthogonal Polynomials see the WWW <http://www.ugr.es/~alhambra2000/4OrtPo.htm> or contact with Francisco Marcellán (pacomarc@ing.uc3m.es) or Miguel Piñar González (mpinar@ugr.es).

Francisco Marcellán
 (pacomarc@ing.uc3m.es)

8. NATO Advanced Study Institute "Approximation, Complex Analysis, and Potential Theory". Département de Mathématiques et de Statistique, Université de Montréal, July 3 - 14, 2000.

The following information is from the WWW page <http://www.dms.umontreal.ca/activite/sms/pub00.htm>

In July 3-14, at the Département de Mathématiques et de Statistique of the Université de Montréal will take place the 39th session of the *Séminaire de Mathématiques Supérieures* in the framework of the NATO ASI 2000.

The number of participants is limited. Participation of doctoral students and postdoctoral fellows is particularly encouraged.

Partial financial assistance will be available for some participants. Priority will be given to graduate students. Requests for participation or financial assistance must be received before February 21, 2000.

There is no registration fee. A contribution of 70\$CA is required for social affairs.

Organising Committee: N. Arakelian, D.H. Armitage, A. Daigneault, D. Drasin, P.M. Gauthier, A. A. Gonchar, S. Lessard, G. Sabidussi.

For further information contact with Ghislaine David (coordinator) (david@DMS.UMontreal.CA). For on-line registration see <http://www.dms.umontreal.ca/activite/sms/form00.htm>

Renato Álvarez-Nodarse
(ran@cica.es)

9. I Colloquium on Lie Theory and Applications. University of Vigo, Vigo, Spain, July 17–22, 2000.

I am pleased to inform you that at the University of Vigo we are organizing the “I Colloquium on Lie Theory and Applications”, which will be held in Vigo (Spain) from July 17 to July 22, 2000.

Some information on the colloquium and a pre-registration form are available in the following web page: <http://www.dma.uvigo.es/clieta/index>

(The following is extracted from the web page - Ed)

FIRST ANNOUNCEMENT

The University of Vigo is pleased to announce the I Colloquium on Lie theory and Applications which will be held at Vigo (Spain) from July 17 to July 22, 2000.

The Colloquium will be the first of a series of conferences devoted to all aspects of Lie Theory and to be held in different locations biennially.

Scientific Programme and Registration: The Colloquium will include three courses, of three hours each, delivered by Professors D.V. Alekseevsky, A.T. Fomenko and M. Scheunert, eleven invited lectures and several short communications (fifteen minutes each). Registration in the colloquium will be possible from February 1 to April 30, 2000. Instructions on the dimensions and style of the abridged version are detailed in the call for communications.

The languages of the colloquium will be English, Spanish and French; the organizing committee, however, encourages the use of English specially in abstracts and in the written version of the communications.

Further information:

1. List of Invited Speakers and Titles:

- (a) Courses: D. V. Alekseevsky: Semisimple Lie algebras, Dynkin diagrammes and geometry of flag manifolds.

A.T. Fomenko: Lie groups and integrable Hamiltonian systems.

M. Scheunert: (Title not provided)

- (b) Lectures: S. Benayadi, M. Bordemann, V. Cortes, A. Gonzalez-Lopez, Yu. B. Hakimjanov, E. Koelink, M. de Leon, E. Macias-Virgos, A. Medina, C. Moreno, and K-H. Neeb.

2. Scientific Committee: D.V. Alekseevsky (Max-Planck Institut für Mathematik, Germany), S. Benayadi (Universite de Metz, France), M. Bordemann (Universität Freiburg, Germany), V. Cortes (Universität Bonn, Germany), A.T. Fomenko (Moscow State University, Russia), A. Gonzalez-Lopez (Universidad Complutense de Madrid, Spain), Yu.B. Hakimjanov (Universite d’Haute Alsace, France), K.H. Hofmann (Tulane University, USA), E. Koelink (Technische Universiteit Delft, The Netherlands), M. de Leon (CSIC, Spain), E. Macias-Virgos (Universidad de Santiago, Spain), A. Medina (Universite de Montpellier II, France), C. Moreno (Universite de Bourgogne, France / Universidad Complutense de Madrid, Spain), K-H. Neeb (Technische Universität Darmstadt, Germany), M. Scheunert (Universität Bonn, Germany).

3. Registration Fees: The registration fees are the following:

- General Fee: 22,000 pesetas (132 Euro)
- Reduced Fees: Participants registered in the 3^{er}cm 18,000 pesetas (108 Euro), Individual members of SEMA 18,000 pesetas (108 Euro), Young Researchers ¹ 16,000 pesetas (96 Euro)

4. Organizing Committee: N. Alonso, I. Bajo, R. Gonzalez, A. Martin and E. Sanmartín (Universidad de Vigo, Spain)

5. Coordination: Ignacio Bajo (Dept. Matematica Aplicada, Universidad de Vigo, Spain) Esperanza Sanmartín (Dept. Matematicas, Universidad de Vigo, Spain)

Address:

I Colloquium on Lie Theory and Applications
E.T.S.I. Telecomunicacion
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Telephone: +86 81 21 52 // +86 81 24 45
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E-mail: clieta@dma.uvigo.es

Sponsors and Collaborating Entities: Universidad de Vigo, Xunta de Galicia, Ministerio de Educación y

¹The “Young researchers” fee is applicable to researchers under 30 who declare to be unemployed or whose net income does not exceed 125,000 pesetas (750 Euro) per month.

Cultura, Real Sociedad Matemática Española (RSME), Sociedad Española de Matemática Aplicada (SEMA), European Mathematical Society (EMS).

Social Programme: The Social Programme of the colloquium will include a closing dinner and a visit to the city of Santiago de Compostela. The city of Santiago de Compostela has been proclaimed one of the Cultural Capitals of Europe 2000.

How to reach Vigo: The city of Vigo, with 300,000 inhabitants, is located in Galicia, a region in the northwest of Spain. The airport of Vigo connects the city with Madrid, Barcelona, Bilbao, Valladolid, Frankfurt and Paris daily. The airport of Santiago de Compostela is the largest airport in Galicia; it is only 90 kilometres from Vigo and has flights to many other international destinations. The city of Porto (Portugal) is approximately 150 kilometres from Vigo and a large number of destinations are possible through its airport. There are regular bus and train services to almost all important towns in Spain and Portugal.

Ignacio Bajo Palacio
(ibajo@dma.uvigo.es)

10. Session on “Adaptive quadrature and cubature formulae” in the Third Congress of Nonlinear Analysts. Catania, Sicily, Italy, July 19-26, 2000.

A session on “Adaptive quadrature and cubature formulae” will be organized within the “Third Congress of Nonlinear Analysts” which will be held during July 19-26, 2000 in Catania, Sicily, Italy.

In addition to the classical approach for adaptive quadrature and cubature formulae which will be welcome in that section, we would like to encourage the following topics in Theory of Inequalities which are related to Numerical Integration:

- Ostrowski Type Inequalities
- Hermite -Hadamard Type Inequalities
- Gruss type inequalities
- Trapezoid, Midpoint, Lobatto, Newton-Cotes Type (Rules and) Inequalities
- Integral Inequalities of Iyengar, Mahajani, Fink, etc... type where the integrals are estimated in terms of Polynomials, Series etc...
- Any other integral inequality which might be of help in approximating Riemann, Riemann-Stieltjes, Lebesgue

or other integrals (Bochner, Denjoy, Perron, Henstock etc...)

If you are interested in participating, please let me know before the 20th of December and I will be able to post you the corresponding documents to register.

For information on The Third World Congress of Non-linear Analysts (WCNA-2000) please consult the web site: <http://www.fit.edu/AcadRes/math/wcna/wcna2000.htm>

Sever S. Dragomir
(sever@matilda.vu.edu.au)

11. SIAG Summer School on Orthogonal Polynomials and Special Functions. Laredo, Spain, July 24-29, 2000.

First Announcement

The SIAM Activity Group (SIAG) on Orthogonal Polynomials and Special Functions intends to organize a series of summer schools starting in 2000. The first such meeting will take place in Laredo, Spain. Laredo is a “small” village located on the Cantabrian coast of Spain (on the Atlantic near Santander). The goal of the Summer School is to give five introductory courses in advanced research topics on Orthogonal Polynomials and Special Functions. There will be special sessions where the participants will have the opportunity to give short research seminars and/or posters, as well as a panel discussion. Because of the limited number of these seminars we kindly ask the participants who want to present their own results to send us (by e-mail), as soon as possible, an abstract (no more than one page). Priority will be given to those talks closely related to the main subjects of the school. Information about registration, registration fee, etc., will be appear in a later announcement. The expected audience are graduate and recent postgraduate students (around 25 people who will receive grants for their living expenses and accommodation) and active researchers (around 35 people).

Organizing Committee: F. Marcellán (Program Director SIAM Activity Group of Orthogonal Polynomials and Special Functions, Universidad Carlos III de Madrid, Spain), W. Van Assche (Vice-Chair SIAG, Katholieke Universiteit Leuven, Belgium), R. Álvarez-Nodarse (Universidad de Sevilla, Spain) and R. Yáñez (Universidad de Granada, Spain) SIAG Newsletter Co-Editors.

Invited Lecturers

1. H. T. Koelink (Technische Universiteit Delft, The Netherlands) “Spectral Theory and Special Functions”

2. A. J. Durán (Universidad de Sevilla, Spain) “Matrix Orthogonal Polynomials”
3. J. Prestin (Institute of Biomathematics and Biometry, Neuherberg, Germany) “Polynomial Wavelets”
4. J. Stokman, “Multivariable Orthogonal Polynomials”
5. K. T-R. McLaughlin (University of Arizona, USA) “Asymptotic Analysis of Riemann-Hilbert Problems and Orthogonal Polynomials”

For more information contact F. Marcellán (pacomarc@ing.uc3m.es) and/or R. Álvarez-Nodarse (ran@cica.es). Further information will be appear in the WWW page <http://merlin.us.es/~renato/laredo/>

Francisco Marcellán
(pacomarc@ing.uc3m.es)
Renato Álvarez-Nodarse
(ran@cica.es)

12. International Symposium on Analysis, Combinatorics and Computing. Dalian, P. R. China, August 5-8, 2000.

First Announcement

Objective: The purpose of this conference is to provide a forum for an exchange of ideas among experts in the various topics listed below, and to disseminate information on recent advances made in these areas.

Session Topics:

1. Special Functions and its Applications
2. Combinatorics and its Applications
3. Approximation Theory and Numerical Analysis
4. Harmonic and Wavelet Analysis

Organizing Committee: Chairman: Leetsch C. Hsu (Xu, Lizhi) (Dalian, PRC); Members: Tian-Xiao He (Illinois, USA), Zhongkai Li (Beijing, PRC), Jun Wang (Dalian, PRC), Sining Zheng (Dalian, PRC).

Academic Committee: Richard Askey (Madison, USA), Paul L. Butzer (Aachen, Germany), Guochen Feng (Changchun, PRC), Leetsch C. Hsu (Dalian, PRC), Peter Shiue (Las Vegas, USA), Lewis Solomon (Madison, USA), Zhexian Wan (Beijing, PRC), Renhong Wang (Dalian, PRC),

Registration fee (including the official fee for the conference and the fee for a reception banquet, daily breakfast, lunch and dinner, but not the room fee. Each participant should pay his room fee separately.) US\$250 before May 31, 2000, US\$300 after May 31, 2000.

Call for Talks and Registration: The organizing committee encourages early registration and submission of original technical and unpublished papers related to the above session topics. Those who reply to the organizers by e-mail or post-mail before February 15, 2000, will receive directly the second announcement, in which the official forms for registration and accommodation are included. Replies after this date will also be accepted. Abstracts of contributed talks must be received by June 30, 2000.

Invited Speakers: Richard Askey (USA), Paul L. Butzer (Germany), Mourad Ismail (USA), Peter Shiue (USA), Lewis Solomon (USA).

Sponsored by Dalian University of Technology

Please contact one of the members of the organizing committee if you are interested in this symposium or have any questions:

Jun Wang
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Tian-Xiao He
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Illinois Wesleyan University
Illinois, USA
Email: the@sun.iwu.edu
Tel: 309-556-3089

Remarks:

- This conference will be held at the Dalian University of Technology, Dalian, China, from August 5 to 8, 2000. For information about the Uni-

versity and the City of Dalian, please visit the following web sites: <http://www.dlut.edu.cn> or <http://www.china-dalian.com/100>

- If you are interested in or wish to participate in the conference, please let us know your following information as soon as possible, which are necessary for you to go through your Chinese visa:

1. Full name (First) (Last)
2. Citizenship
3. Date of birth (month, day, and year)
4. City and country of birth
5. Passport number
6. Correspondence address

Li Zhongkai
(lizk@mail.cnu.edu.cn)

13. International Symposium on Applied Mathematics, Dalian, P.R. China, August, 14-18, 2000

The following information is from a poster.

Main Sessions:

- Applied Partial Differential Equations
- Applied Probability and Statistics
- Approximation Theory
- Asymptotic Analysis
- Computational Geometry
- Dynamical Systems and Fractals
- Scientific Computing
- Special Functions
- Wavelets

Plenary Speakers:

- A. Jeffrey (University of Newcastle Upon Tyne, UK)
- D. Benney (MIT, USA)
- L. Gatteschi (University of Torino, Italy)
- W. Gautschi (Purdue University, USA)
- T.-T. Li (Fudan University, China)
- Q. Lin (Chinese Academy of Sciences, China)
- Z.-M. Ma (Chinese Academy of Sciences, China)

- C. A. Michelli (IBM, USA)
- R. Miura (University of British Columbia, Canada)
- B. Moodie (University of Alberta, Canada)
- O. Nevanlinna (Helsinki University of Technology, Finland)
- Z.-C. Shi (Chinese Academy of Sciences, China)
- U. Shokin (Russian Academy of Sciences, Russia)
- B. Sleeman (University of Leeds, UK)

Scientific Committee:

- R.-H. Wang (Dalian University of Technology)
- R. Wong (City University of Hong Kong)

Conference Co-ordinators:

- W. Wu (Dalian University of Technology)
- Benny Hon (City University of Hong Kong)

Deadline for submitting abstracts: March 31, 2000

Local Contact Person:

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Martin Muldoon
(muldoon@yorku.ca)

14. 4th International Conference on Functional Analysis and Approximation Theory. Acquafredda di Maratea, Italy, September 22-28, 2000.

The following information is from the WWW page <http://www.dm.uniba.it/maratea/index.htm>

The fourth edition of the *4th International Conference on Functional Analysis and Approximation Theory* is organized in the sphere of activities of the Center for Studies in Functional Analysis and Approximation Theory of the University of Basilicata (Potenza), with the collaboration of the Department of Mathematics of the University of Basilicata (Potenza), the Department of Mathematics of the University and the Polytechnic of Bari. Moreover it will be held under the auspices of the University of Basilicata, the University of Bari, the Polytechnic of Bari,

the National Group of Functional Analysis and Applications (G.N.A.F.A.) and the Progetti di Ricerca di Interesse Nazionale: Analisi Funzionale (M.U.R.S.T.).

The meeting will be devoted to some significant aspects of contemporary mathematical research on Functional Analysis and Approximation Theory including the applications of these fields in other areas. Suggested topics include:

- Banach spaces, Banach lattices, function spaces.
- (Positive) linear operators, semigroups of (positive) linear operators, evolution equations.
- Approximate quadratures and integral equations.
- Approximation methods in abstract spaces and in function spaces, approximation by (positive) operators, interpolation, polynomial approximation.
- Constructive approximation.
- Orthogonal polynomials.

The scientific program will consist of invited survey talks (45 minutes) and short communications (20 minutes).

The abstracts of all contributions and the program of the meeting will be available at the beginning of the meeting.

The **organizing committee** consists of Francesco Altomare (University of Bari), Antonio Attalienti (University of Bari), Michele Campiti (Polytechnic of Bari), Bianca-maria Della Vecchia (University of Roma “La Sapienza”), Giuseppe Mastroianni (University of Basilicata), Mario Rosario Occorsio (University of Napoli).

The **invited speakers** are: Pietro Aiena, Palermo, Italy; Hubert Berens, Erlangen, Germany; Philippe Clément, Delft, The Netherlands; Tamas Erdelyi, Texas A&M, U.S.A.; Carlo Franchetti, Firenze, Italy; Gilles Godefroy, Paris, France; Doron S. Lubinsky, Johannesburg, South Africa; Gradimir Milovanovic, Nis, Serbia; Giovanni Monegato, Torino, Italy; Michael M. Neumann, Mississippi, U.S.A.; Pier Luigi Papini, Bologna, Italy; Ioan Rasa, Cluj-Napoca, Romania; Bernd Silbermann, Chemnitz, Germany; Vilmos Totik, Szeged, Hungary (To be confirmed); Peter Vertesi, Budapest, Hungary; Lutz Weiss, Karlsruhe, Germany.

A preliminary list of all participants will be sent together with the second announcement and will be published on the Web page of the Conference as soon as possible.

It is expected that the proceedings of the Conference will be published.

For further information see the WWW page <http://www.dm.uniba.it/maratea/index.htm> or

contact with the Organizing Committee by e-mail to the address: maratea@dm.uniba.it

Renato Álvarez-Nodarse
(ran@cica.es)

Future Planning

At the Hong Kong panel discussion there was a proposal that the SIAM activity group might provide coordination for the future planning of meetings on orthogonal polynomials and special functions. From now on the activity group’s newsletter will keep a list of dates and plans for meetings, with contact addresses of local responsible people.

If you are planning to organize a workshop, summer school, conference, special session, etc., we suggest that you inform one of the officers of the SIAM activity group and we will keep the activity group informed by publishing the intended date in the newsletter, so as to avoid the coincidence of several meetings. Please contact the local organizers in case of conflict or for finding a solution for possible overlap. The SIAM activity group will not be involved in the actual organization.

- 2000. A summer school will be organized in Laredo, Spain from July 24 to July 29. Contact Francisco Marcellán for more details (pacomarc@ing.uc3m.es) [see also the item 10 of the Forthcoming Meetings and Conferences section of this issue]
- 2001.
 - Andrea Laforgia expressed an intention to organize the next conference in the “European Series” on orthogonal polynomials and their applications in Italy, probably in late June. Please contact him at laforgia@dma.uniroma3.it.
 - There are plans for a summer school in Munich. The contact person is Jürgen Prestin (prestin@gsf.de)
- 2002. The next meeting on Special Functions in the Honk Kong (1999), Arizona (NATO ASI, 2000) series, will be organized by Tom Koornwinder, Nico Temme and Eric Koelink in Amsterdam, probably in early summer. Please contact thk@wins.uva.nl, nicot@cwi.nl or koelink@twi.tudelft.nl for coordination purposes. There is also a plan to organize a summer school just before the conference. Contact Erik Koelink (koelink@twi.tudelft.nl) for information.

Walter Van Assche
(walter@wis.kuleuven.ac.be)

Books and Journals

Book Announcements

1. Gröbner Deformations of Hypergeometric Differential Equations

M. Saito, B. Sturmfels, and N. Takayama

Springer 1999. VIII, 254 pp. 14 figs. ISBN: 3-540-66065-8. Series: Algorithms and Computation in Mathematics. Vol. 6.

In recent years, new algorithms for dealing with rings of differential operators have been discovered and implemented. A main tool is the theory of Gröbner bases, which is reexamined here from the point of view of geometric deformations. Perturbation techniques have a long tradition in analysis; Gröbner deformations of left ideals in the Weyl algebra are the algebraic analogue to classical perturbation techniques. The algorithmic methods introduced here are particularly useful for studying the systems of multi-dimensional hypergeometric PDEs introduced by Gelfand, Kapranov and Zelevinsky. The Gröbner deformation of these GKZ hypergeometric systems reduces problems concerning hypergeometric functions to questions about commutative monomial ideals, and leads to an unexpected interplay between analysis and combinatorics. This book contains a number of original research results on holonomic systems and hypergeometric functions, and raises many open problems for future research in this area.

Keywords: hypergeometric functions, Gröbner bases, holonomic systems, Weyl algebra, combinatorial commutative algebra

Contents:

Chapter 1. Basic Notions.

Chapter 2. Gröbner Deformations of Regular Holonomic Systems.

Chapter 3. Hypergeometric Series.

Chapter 4. Rank versus volume.

Chapter 5. Integration of D-modules

Bernd Sturmfels
(bernd@math.berkeley.edu)

OP-SF preprints

In this section we will include information on some recent preprints related to Orthogonal Polynomials and Special Functions that were recently posted or cross-listed to one of the subcategories of the xxx archives. See:

- <http://front.math.ucdavis.edu/math.CA>
- <http://front.math.ucdavis.edu/math.CO>
- <http://front.math.ucdavis.edu/math.QA>
- <http://xxx.lanl.gov/archive/solv-int>

1. E-print math.QA/0001033

Title: *Askey-Wilson polynomials: an affine Hecke algebraic approach*

Authors: Masatoshi Noumi, Jasper V. Stokman

Categories: QA Quantum Algebra (CA Classical Analysis; RT Representation Theory)

Math Subject Class: 33D45, 33D80

Comments: 35 pages

Abstract We study Askey-Wilson type polynomials using representation theory of the double affine Hecke algebra. In particular, we prove bi-orthogonality relations for non-symmetric and anti-symmetric Askey-Wilson polynomials with respect to a complex measure. We give duality properties of the non-symmetric Askey-Wilson polynomials, and we show how the non-symmetric Askey-Wilson polynomials can be created from Sahi's intertwiners. The diagonal terms associated to the bi-orthogonality relations (which replace the notion of quadratic norm evaluations for orthogonal polynomials) are expressed in terms of residues of the complex weight function using intertwining properties of the non-symmetric Askey-Wilson transform under the action of the double affine Hecke algebra. We evaluate the constant term, which is essentially the well-known Askey-Wilson integral, using shift operators. We furthermore show how these results reduce to well-known properties of the symmetric Askey-Wilson polynomials, as were originally derived by Askey and Wilson using basic hypergeometric series theory.

2. E-print math.CA/9912149

Title: *A remark on perturbations of sine and cosine sums*

Author: Mihail N. Kolountzakis

Categories: CA Classical Analysis

Math Subject Class: 42A05

Comments: 2 pages

Abstract: Consider a collection $\lambda_1 < \dots < \lambda_N$ of distinct positive integers and the quantities

$$M_1 = M_1(\lambda_1, \dots, \lambda_N) = \max_{0 \leq x \leq 2\pi} \left| \sum_{j=1}^N \sin \lambda_j x \right|$$

and

$$M_2 = M_2(\lambda_1, \dots, \lambda_N) = - \min_{0 \leq x \leq 2\pi} \sum_{j=1}^N \cos \lambda_j x.$$

Prompted by a discussion with G. Benke we prove that collections of frequencies λ_j which have $M_1 = o(N)$ or $M_2 = o(N)$ are unstable, in the sense that one can perturb the λ_j by one each and get $M_1 \geq cN$ and $M_2 \geq cN$.

3. E-print math.CA/9912140

Title: *The Askey-Wilson function transform scheme*
 Authors: Erik Koelink, Jasper V. Stokman
 Categories: CA Classical Analysis (QA Quantum Algebra)
 Math Subject Class: 33D15, 33D45 (Primary) 33D80 (Secondary)
 Comments: 17 pages, 2 figures, AMS-TeX Some formulas corrected, reference updated

Abstract: In this paper we present an addition to Askey's scheme of q -hypergeometric orthogonal polynomials involving classes of q -special functions which do not consist of polynomials only. The special functions are q -analogues of the Jacobi and Bessel function, and are Askey-Wilson functions, big q -Jacobi functions and little q -Jacobi functions and the corresponding q -Bessel functions. The generalised orthogonality relations and the second order q -difference equations for these families are given. Limit transitions between these families are discussed. The quantum group theoretic interpretations are discussed shortly.

4. E-print math.CA/9912113

Title: *On the q -convolution on the line*
 Author: Giovanna Carnovale
 Categories: CA Classical Analysis (QA Quantum Algebra)
 Math Subject Class: 33D80; 33D15; 42A85 (primary); 17B37 (secondary)
 Report number: 33/99

Abstract: I continue the investigation of a q -analogue of the convolution on the line started in a joint work with Koornwinder and based on a formal definition due to Kempf and Majid. Two different ways of approximating functions by means of the convolution and convolution of delta functions are introduced. A new family of functions that forms an increasing chain of algebras depending on a parameter $s > 0$ is constructed. The value of the parameter for which the mentioned algebras are well behaved, commutative and unital is found. In particular a privileged algebra of functions belonging to the above family is shown to be the quotient of an algebra studied in the previous article modulo the kernel of a q -analogue of the Fourier transform. This result has an analytic interpretation in terms of analytic functions whose q -moments have a particular behaviour. The same result makes it possible to extend results on invertibility of the q -Fourier transform due to Koornwinder. A few results on invertibility of functions with respect to the q -convolution are also obtained and they are related to solving certain simple linear q -difference equations with polynomial coefficients.

5. E-print math-ph/9912020

Title: *One Dimensional Regularizations of the Coulomb Potential with Application to Atoms in Strong Magnetic Fields*
 Authors: Raymond Brummelhuis, Mary Beth Ruskai, Elisabeth Werner
 Categories: MP Mathematical Physics (CA Classical Analysis)
 Math Subject Class: 81V45, 33E20
 Journal reference: *Differential Equations and Mathematical Physics*, ed. by G. Weinstein and R. Weikard, pp. 43-51 (International Press, 2000)
 Comments: 9 pages, Proceedings of a conference on Differential Equations and Mathematical Physics at University of Alabama Birmingham (March 1998)

Abstract: We consider one-dimensional regularizations of the Coulomb potential formed by taking a two-dimensional expectation of the Coulomb potential with respect to the Landau states. It is well-known that such functions arises naturally in the study of atoms in strong magnetic fields. For many-electron atoms consideration of the Pauli principle requires convex combinations of such potentials and interactions in which the regularizations also contain a $2^{-1/2}$ rescaling. We summarize the results of a comprehensive study of these functions including recursion relations, tight bounds, convexity properties, and connections with confluent hypergeometric functions. We also report briefly on their application in one-dimensional models of many-electrons atoms in strong magnetic fields.

6. E-print math.PR/9912170

Title: *Probability laws related to the Jacobi theta and Riemann zeta function and Brownian excursions*
 Authors: P. Biane, J. Pitman, M. Yor
 Categories: PR Probability Theory (CA Classical Analysis)
 Math Subject Class: 11M06; 60J65; 60E07
 Report number: DMA-99-30
 Comments: LaTeX; 40 pages; review paper

Abstract: This paper reviews known results which connect Riemann's integral representations of his zeta function, involving Jacobi's theta function and its derivatives, to some particular probability laws governing sums of independent exponential variables. These laws are related to one-dimensional Brownian motion and to higher dimensional Bessel processes. We present some characterizations of these probability laws, and some approximations of Riemann's zeta function which are related to these laws.

7. E-print math.QA/9911163

Title: *Fourier transforms on the quantum $SU(1,1)$*

group

Authors: Erik Koelink, Jasper Stokman, Mizan Rahman (appendix)

Categories: QA Quantum Algebra (CA Classical Analysis)

Math Subject Class: 17B37, 33D55, 33D80 (Primary) 43A32, 43A90, 46L89, 47B15 (Secondary)

Comments: 77 pages, 1 figure

Abstract: The main goal is to interpret the Askey-Wilson function and the corresponding transform pair on the quantum $SU(1,1)$ group. A weight on the C^* -algebra of continuous functions vanishing at infinity on the quantum $SU(1,1)$ group is studied, which is left and right invariant in a weak sense with respect to a product defined using Wall functions. The Haar weight restricted to certain subalgebras are explicitly determined in terms of an infinitely supported Jackson integral and in terms of an infinitely supported Askey-Wilson type measure. For the evaluation the spectral analysis of explicit unbounded doubly infinite Jacobi matrices and some new summation formulas for basic hypergeometric series are needed. The spherical functions are calculated in terms of Askey-Wilson functions and big q -Jacobi functions. The corresponding spherical Fourier transforms are identified with special cases of the big q -Jacobi function transform and of the Askey-Wilson function transform.

8. E-print math.CO/9912093

Title: *Riemann-Hilbert problem and the discrete Bessel kernel*

Author: Alexei Borodin

Categories: CO Combinatorics (MP Mathematical Physics)

Comments: AMSTeX, 17 pages

Abstract: We use discrete analogs of Riemann-Hilbert problem's methods to derive the discrete Bessel kernel which describes the poissonized Plancherel measures for symmetric groups. To do this we define a discrete analog of 2 by 2 Riemann-Hilbert problems of special type. We also give an example, explicitly solvable in terms of classical special functions, when a discrete Riemann-Hilbert problem converges in a certain scaling limit to a conventional one; the example originates from the representation theory of the infinite symmetric group.

9. E-print math.CO/9912052

Title: *Restricted permutations, continued fractions, and Chebyshev polynomials*

Authors: T. Mansour, A. Vainshtein

Categories: CO Combinatorics

Abstract: Let $f_n^r(k)$ be the number of 132-avoiding permutations on n letters that contain exactly r occurrences of $12\dots k$, and let $F_r(x;k)$ and $F(x,y;k)$ be the generating functions defined by $F_r(x;k) = \sum_{n \geq 0} f_n^r(k)x^n$ and $F(x,y;k) = \sum_{r \geq 0} F_r(x;k)y^r$. We find an explicit expression for $F(x,y;k)$ in the form of a continued fraction. This allows us to express $F_r(x;k)$ for $1 \leq r \leq k$ via Chebyshev polynomials of the second kind.

10. E-print math.QA/9912094

Title: *Ubiquity of Kostka polynomials*

Author: Anatol N. Kirillov

Categories: QA Quantum Algebra (CO Combinatorics)

Comments: LaTeX, 60 pages, some typos corrected, and new exercises added

Abstract: We report about results revolving around Kostka-Foulkes and parabolic Kostka polynomials and their connections with Representation Theory and Combinatorics. It appears (see Section 7) that the set of all parabolic Kostka polynomials forms a semigroup, which we call Liskova semigroup. We show that polynomials frequently appearing in Representation Theory and Combinatorics belong to the Liskova semigroup. Among such polynomials we study rectangular q -Catalan numbers; generalized exponents polynomials; principal specializations of the internal product of Schur functions; generalized q -Gaussian polynomials; parabolic Kostant partition function and its q -analog; certain generating functions on the set of transportation matrices. In each case we apply rigged configurations technique to obtain some interesting information about Kostka-Foulkes polynomials, Kostant partition function, MacMahon, Gelfand-Tsetlin and Chan-Robbins polytopes. We study also some properties of l -restricted generalized exponents and the stable behaviour of certain Kostka-Foulkes polynomials.

11. E-print math.AG/9911030

Title: *Rational Hypergeometric Functions*

Authors: Eduardo Cattani, Alicia Dickenstein, Bernd Sturmfels

Categories: AG Algebraic Geometry (CO Combinatorics)

Report number: MSRI 1999-051

Comments: LaTeX, 26 pages

Abstract: Multivariate hypergeometric functions associated with toric varieties were introduced by Gelfand, Kapranov and Zelevinsky. Singularities of such functions are discriminants, that is, divisors projectively dual to torus orbit closures. We show that most of these potential denominators never appear

in rational hypergeometric functions. We conjecture that the denominator of any rational hypergeometric function is a product of resultants, that is, a product of special discriminants arising from Cayley configurations. This conjecture is proved for toric hypersurfaces and for toric varieties of dimension at most three. Toric residues are applied to show that every toric resultant appears in the denominator of some rational hypergeometric function.

12. nlin.SI/0001001

Title: *Fermionic representation for basic hypergeometric functions related to Schur polynomials*

Authors: A.Yu.Orlov, D.M.Scherbin

Subj-class: Exactly Solvable and Integrable Systems

Abstract: We present the fermionic representation for the q -deformed hypergeometric functions related to Schur polynomials. For $q=1$ it is known that these hypergeometric functions are related to zonal spherical polynomials for $GL(N, C)/U(N)$ symmetric space. Multivariable hypergeometric functions appear to be tau-functions of the KP and of the two-dimensional Toda lattice hierarchies. The variables of the hypergeometric functions are the higher times of those hierarchies. The discrete Toda lattice variable shifts parameters of hypergeometric functions.

13. math-ph/0001003

Title: *Matrix Factorization for an $SO(2)$ Spinning Top and Related Problems*

Authors: Aleksandar Mikovic

Comments: 11 pages, Latex

Subj-class: Mathematical Physics; Exactly Solvable and Integrable Systems

Abstract: We study the matrix factorization problem associated with an $SO(2)$ spinning top by using the algebro-geometric approach. We derive the explicit expressions in terms of Riemann theta functions and discuss some related problems including a non-compact extension and the case when the Lax matrix contains higher-order powers of the spectral parameter.

14. solv-int/9912006

Title: *Group Theoretical Properties and Band Structure of the Lamé Hamiltonian*

Authors: Hui Li, Dimitri Kusnezov, Francesco Iachello

Comments: 21 pages Revtex + 6 eps + 2 jpg figures

Subj-class: Exactly Solvable and Integrable Systems

Abstract: We study the group theoretical properties of the Lamé equation and its relation to $su(1,1)$ and

$su(2)$. We compute the band structure, dispersion relation and transfer matrix and discuss the dynamical symmetry limits.

Problems and Solutions

Thus far 20 problems have been submitted seven of which have been solved in previous issues. Still unsolved are Problems #3, 5, 8, 9, 11, 12, 13, 15, 17, 18, 19 and 20. This time no new problems have been submitted.

19. Uniform Bounds for Shifted Jacobi Multiplier Sequences. For Fourier series the following is immediate: Suppose the real or complex sequence $\{m_k\}$ generates a bounded operator on $L^p(\mathbf{T})$, $1 \leq p \leq \infty$, i.e., for polynomial f

$$\left\| \sum m_k \hat{f}_k e^{ik\varphi} \right\|_{L^p(\mathbf{T})} \leq \|m\|_{M^p(\mathbf{T})} \left\| \sum \hat{f}_k e^{ik\varphi} \right\|_{L^p(\mathbf{T})},$$

then one has for the shifted sequence $\{m_{k+j}\}_{k \in \mathbf{Z}}$ that

$$\sup_{j \in \mathbf{N}_0} \|\{m_{k+j}\}\|_{M^p(\mathbf{T})} \leq C \|m\|_{M^p(\mathbf{T})}, \quad 1 \leq p \leq \infty. \quad (1)$$

Looking at cosine expansions on $L^p(0, \pi)$ one easily derives the analog of (1) via the addition formula

$$\cos(k \pm j)\theta = \cos k\theta \cos j\theta \mp \sin k\theta \sin j\theta$$

provided the periodic Hilbert transform is bounded, i.e., for $1 < p < \infty$. More generally, by Muckenhoupt's transplantation theorem [2, Theorem 1.6],

$$\begin{aligned} & \left(\int_0^\pi \left| \sum m_{k+j} a_k P_k^{(\alpha, \beta)}(\cos \theta) \right|^p \sin^{2\alpha+1} \frac{\theta}{2} \cos^{2\beta+1} \frac{\theta}{2} d\theta \right)^{1/p} \\ & \equiv \left(\int_0^\pi \left| \sum m_{k+j} b_k \phi_k^{(\alpha, \beta)}(\cos \theta) \right|^p w_{\alpha, \beta, p}(\theta) d\theta \right)^{1/p} \\ & \approx \left(\int_0^\pi \left| \sum m_{k+j} b_k \cos k\theta \right|^p w_{\alpha, \beta, p}(\theta) d\theta \right)^{1/p}, \end{aligned}$$

where $P_k^{(\alpha, \beta)}$ are the Jacobi polynomials, $\phi_k^{(\alpha, \beta)}(\cos \theta)$ are the orthonormalized Jacobi functions with respect to $d\theta$, and

$$w_{\alpha, \beta, p}(\theta) = \sin^{(2-p)(\alpha+1/2)} \frac{\theta}{2} \cos^{(2-p)(\beta+1/2)} \frac{\theta}{2}.$$

Therefore, the above argument for cosine expansions also applies to Jacobi expansions provided the periodic Hilbert transform is bounded with respect to the weight function $w_{\alpha, \beta, p}$; hence, the analog of (1) holds for Jacobi expansions when

$$\frac{2\alpha+2}{\alpha+3/2} < p < \frac{2\alpha+2}{\alpha+1/2}, \quad \alpha \geq \beta \geq -\frac{1}{2}.$$

(i) Can the above p -range be extended? By Muckenhoupt [2, (1.3)], a fixed shift is bounded for all p , $1 < p < \infty$.

(ii) Consider the corresponding problem for Laguerre expansions (for the appropriate setting see [1]); a fixed shift is easily seen to be bounded for all $p \geq 1$.

Both questions are of course trivial for $p = 2$ since $\ell^\infty = M^2$ by Parseval's formula.

References

- [1] Gasper, G. and W. Trebels: On necessary multiplier conditions for Laguerre expansions, *Canad. J. Math.* 43 (1991), 1228 – 1242.
- [2] Muckenhoupt, B.: Transplantation Theorems and Multiplier Theorems for Jacobi Series, *Memoirs Amer. Math. Soc.*, Vol. 64, No. 356, Providence, R.I., 1986.

(Submitted on May 19, 1998)

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20. Question about Elliot's formula Generalization of Legendre's identity for complete elliptic integrals

Let E, K be the complete elliptic integrals. Then

$$K'E + KE' - KK' = \pi/2 \quad (*)$$

This is the special case $p = r = -a + 1/2$, $q = c + a - 3/2$ in Elliott's identity (see Erdelyi e.a., *Higher Transcendental Functions*, Vol. 1, p. 85):

$$\begin{aligned} & F(p + \frac{1}{2}, -r - \frac{1}{2}, 1 + p + q; z) F(-p + \frac{1}{2}, r + \frac{1}{2}; 1 + q + r; 1 - z) \\ & + F(p + \frac{1}{2}, -r + \frac{1}{2}, 1 + p + q; z) F(-p - \frac{1}{2}, r + \frac{1}{2}; 1 + q + r; 1 - z) \\ & - F(p + \frac{1}{2}, -r + \frac{1}{2}, 1 + p + q; z) F(-p + \frac{1}{2}, r + \frac{1}{2}; 1 + q + r; 1 - z) \\ & = \frac{\Gamma(p + q + 1)\Gamma(q + r + 1)}{\Gamma(p + q + r + \frac{3}{2})\Gamma(q + \frac{1}{2})} \quad (**) \end{aligned}$$

Question 1. Is there a counterpart of Legendre's identity (*) for incomplete elliptic integrals?

Question 2. The Elliott identity (**) provides a generalization of the identity (*) to hypergeometric functions. The only handbook where I have seen this identity is Bateman vol. I. Has Elliott's identity been used or mentioned elsewhere in papers/books?

Question 3. Are there generalizations of the Elliott identity (**) to the ${}_pF_q$ case or to other generalizations of hypergeometric functions?

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21. Question on an exact solvable Schrödinger equation

What are all the Schrödinger equations that have exact solutions expressible in terms of the Kampé de Fériet function?

(Submitted on June 3, 1999)

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Note: B. A. Aničín, "Circuit theory of video display lines", *IEE Proc.- Micro. Antennas Propag*, 146(1), February 1999, pp. 65-69, acknowledges the help of Professors J. Boersma and M. L. Glasser with certain integral relations which arose in the study in question. Questions concerning these integrals were posed by Aničín in OP-SF NET 5.1. (see the Newsletter volume 8, number 2, February 1998)

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Miscellaneous

1. Doron Zeilberger's Maple Packages and Programs

The following is from the web site: <http://www.math.temple.edu/~zeilberg/programs.html>

EKHAD, a Maple package for proving binomial coefficients and other types of identities. To use it, download it as EKHAD, go into Maple, type 'read EKHAD:', and follow the instructions given there. Version of Feb. 25, 1999: This new version benefited from a GREAT SUGGESTION of Frederic CHYZAK (whom we thank so much!), and now is roughly four times as fast. It may not work on very early versions of Maple, in which case you still use the Old Version of EKHAD.

qEKHAD, a Maple package for proving q-binomial coefficients (a.k.a. basic-hypergeometric, and q-) identities. To use it, download it as qEKHAD, go into Maple, type 'read qEKHAD:', and follow the instructions given there. Version of July 20, 1999: The new version implements the above suggestion of Frederic CHYZAK, but the speed-up is not so dramatic. If you have a very early versions of Maple, you may need the Old Version of qEKHAD.

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2. Changes at Methods and Applications of Analysis

The journal "Methods and Applications of Analysis" has new Editors-in-Chief, Zhouping Xin (Courant Institute and Chinese University of Hong Kong) and Shing-Tung Yau (Harvard University) replacing the founding Editors-in-Chief, Roderick Wong and Robert Miura. Roderick and Robert deserve the heartfelt thanks of the OP and SF community for their service in providing such an excellent journal for the publication of work in our areas and related parts of mathematics. In par-

ticular, Roderick Wong took on and continued this work at the same time as he moved to the City University of Hong Kong and undertook heavy administrative responsibilities.

Information on the journal is maintained at the web site:
<http://www.intlpress.com/journals/maa/index.html>

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3. Special issues of Methods and Applications of Analysis in honour of Richard Askey

Richard Askey turned 65 in June 1998 and, some time before that, Mourad Ismail and Dennis Stanton started to solicit articles for a special issue of "Methods and Application of Analysis" in his honour. Dick had been on the Editorial Board of the journal since its inception and had been for 20 years on the Editorial Board of SIAM Journal on Mathematical Analysis for 20 years before that. As the Special Issue Editors explain in a tribute to Askey (Vol 6, no 1, March 1999), the response was overwhelming and so far the articles received and accepted have filled nos 1 and 2 and others are just now appearing in no 3.

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4. SIAM Student Paper Prizes

The annual SIAM Student Paper Prizes will be awarded during the 2000 SIAM Annual Meeting, July 10-14, at the Westin Rio Mar Beach Resort in Rio Grande, Puerto Rico.

If you are a student or know of a student who would like to take part in the competition, here are the details:

The authors of the three best papers in applied and computational mathematics written by students and submitted to SIAM will receive a \$1,000 cash prize and a framed calligraphed certificate as well as gratis registration for the meeting. There is no provision for travel expenses associated with the prize.

Papers must be singly authored and not previously published or submitted for publication to be eligible for consideration. To qualify, authors must be students in good standing who have not received their PhDs at the time of submission.

In submitting their work for publication, authors are asked to consider SIAM journals. However, student paper prize winners are not guaranteed publication in any SIAM journal; all papers submitted to SIAM journals are subject to the same refereeing process and standards.

Submissions must be received in the SIAM office before February 15, 2000.

Submissions, which must be in English, can be sent by regular mail or fax. Each submission must include (1) an extended abstract NOT LONGER THAN 5 PAGES (including bibliography); (2) the complete paper, which will be used solely for clarification of any questions; (3) a statement by the student's faculty advisor that the paper has been prepared by the author indicated and that the author is a student in good standing; (4) a letter by the student's faculty advisor describing and evaluating the paper's contribution; and (5) a short biography of the student.

Submissions will be judged on originality, significance, and

quality of exposition.

The winners will be notified by April 15, 2000.

Please direct your submission and any questions you may have to A. Bogardo at SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688; telephone (215) 382-9800; e-mail to bogardo@siam.org.

Allison Bogardo
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5. SIAM Student Travel Awards

During 2000, SIAM will make a number of awards for \$300 to support student travel to each of the following SIAM conferences:

1. Third SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, Pennsylvania, May 21-24.
2. Tenth SIAM Conference on Discrete Mathematics (SIAG/DM), Minneapolis, Minnesota, June 12-15.
3. 2000 SIAM Annual Meeting, Rio Grande, Puerto Rico, July 10-14.
4. Pacific Rim Dynamical Systems Conference (SIAG/DS), Maui, Hawaii, August 10-12
5. First SIAM Conference on Computational Science and Engineering, Washington, DC, September 21-23.
6. Seventh SIAM Conference on Applied Linear Algebra, Raleigh, North Carolina, October 23-26.

The awards are to be made from the SIAM Student Travel Fund, created in 1991 and maintained through book royalties donated by generous SIAM authors.

Any full-time student in good standing is eligible to receive an award plus gratis meeting registration. Top priority will be given to students presenting papers at the meeting, with second priority to students who are co-authors of papers to be presented at the meetings. Only students traveling more than 100 miles to the meetings are eligible for the awards.

An application for a travel award must include:

1. A letter from the student describing his/her academic standing and interests, his/her expected graduation date and degree, advisor's name, and, if available, a URL for a working Web page.
2. A one-page vita that includes the student's research interests, projects, and papers published.
3. A detailed letter from the student's faculty advisor indicating why the student is deserving of receiving a travel award and any special circumstances.
4. If applicable, the title(s) of the paper(s) to be presented (co-authored) by the student at the meeting.

Applications should be sent to the SIAM office (Attention: SIAM Student Travel Awards), 3600 University City Science Center, Philadelphia, PA 19104-2688. Students also may apply by e-mail to bogardo@siam.org or by fax to 215-386-7999.

Complete applications must be received at the SIAM office no later than TWO MONTHS before the first day of the meeting for which support is requested.

Winners will be notified FIVE WEEKS before the first day of the meeting. Checks for the awards will be given to the student awardees when they arrive at the given meeting and pick up their registration packet at the SIAM Registration Desk.

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How to Contribute to the Newsletter

Send your Newsletter contributions directly to one of the Co-editors:

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preferably by e-mail, and in L^AT_EX format. Other formats are also acceptable and can be submitted by e-mail, regular mail or fax.

Deadline for submissions to be included in the June issue 2000 is May 15, 2000.

Back issues of the Newsletter can be obtained from <http://www.imn.htwk-leipzig.de/~koepf/siam.html>.

The Activity Group also sponsors an electronic news net, called the **OP-SF Net**, which is transmitted periodically by SIAM. The Net provides a rather fast turnaround compared to the Newsletter. To receive transmissions, just send your name and e-mail address to poly-request@siam.org (as with other nets, nonmembers can also receive the transmissions). Your OP-SF Net *contributions* should be sent to poly@siam.org. Please note that submissions to OP-SF Net are automatically considered for publication in the Newsletter, and vice versa, unless the writer requests otherwise.

The Net is organized by Martin Muldoon (muldoon@yorku.ca). Back issues of OP-SF Net can be obtained by anonymous ftp from [ftp.wins.uva.nl](ftp:wins.uva.nl), in the directory `pub/mathematics/reports/Analysis/koornwinder/opsfnet.dir` or by WWW at the addresses <http://turing.wins.uva.nl/~thk/opsfnet/>

<http://www.math.ohio-state.edu/JAT>

<http://math.nist.gov/opsf/archive>

Martin Muldoon also manages our home page

<http://www.math.yorku.ca/siamopsf/>

on World Wide Web. Here you will find also a WWW version of the OP-SF Net. It currently covers the topics

- Conference Calendar
- Books, Conference Proceedings, etc.
- Compendia, tools, etc.
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- Meeting Reports
- Projects
- Problems
- Personal, Obituaries, etc.
- History
- Positions available
- Miscellaneous
- Memberlist
- Links to WWW pages of interest to members

Activity Group: Addresses

The *SIAM Activity Group on Orthogonal Polynomials and Special Functions* consists of a broad set of mathematicians, both pure and applied. The Group also includes engineers and scientists, students as well as experts. We now have around 140 members scattered about in more than 20 countries. Whatever your specialty might be, we welcome your participation in this classical, and yet modern, topic. Our WWW home page <http://www.math.yorku.ca/siamopsf/> is managed by Martin Muldoon (muldoon@yorku.ca).

The *Newsletter* is a publication of the *SIAM Activity Group on Orthogonal Polynomials and Special Functions*, published three times a year. To receive the Newsletter, you must first be a member of SIAM so that you can join the Activity Group. The annual dues are \$96 for SIAM plus \$10 for the Group; students pay \$20/year with free membership in one activity group; postgraduates can become members of SIAM for \$45/year. To join, contact:

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