Orthogonal Polynomials and Special Functions

SIAM Activity Group on Orthogonal Polynomials and Special Functions

★ ★ ★ ★ **Newsletter** ★ ★ ★ ★

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Contents

From the Editors

The most recent issue of the Newsletter was two months late in reaching readers, due to a lack of coordination at SIAM headquarters and some confusion between us (the Editors) and SIAM. They have apologized and promised that it will not happen again.

We held back the current issue in order to be able to report on the recent major event in the OP-SF calendar: "Special functions 2000" in Tempe, Arizona. USA. Starting on page 2, Walter Van Assche reports on the closing session on "future directions" and on pages 6–7, Bill Connett and Kathy Driver give their impressions on the meeting as a whole.

Some items for this issue have come from OP-SF NET and others have reached us directly in recent days. We hope that you find this issue interesting and useful.

June 20, 2000

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Memorial Note about José Javier (Chicho) Guadalupe (1946 - 2000)

Prof. José J. Guadalupe (Chicho) died on April 1, 2000 at the age of 54 in a car accident. He was born in Santa Cruz de la Palma (Canary Islands) and studied at the University of Zaragoza, Spain.

He worked at the University of Zaragoza (1970-1992) and the University of La Rioja (1992-2000).

Chicho was a student of José Luis Rubio de Francia under whose supervision he prepared his Ph.D. on "Closure in $L^p(\mu)$ of analytical polynomials in the unit circle" at the University of Zaragoza.

His general area of research was harmonic analysis. His early work was on closure of analytical polynomials on weighted Jordan curves. Later he worked on Fourier series in orthogonal polynomials and special functions. Recently, he was interested in Stieltjes polynomials and varying measures.

He was a very active man, and organizer of mathematical activities. In the field of orthogonal polynomials and special functions, Chicho promoted the idea of having a series of Spanish Symposia Symposia of Orthogonal Polynomials and Applications. The first Symposium was organized by him in Logroño in 1983.

His death is a great loss for his colleagues and mainly for Spanish people working on orthogonal polynomials and special functions.

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Future Directions

On the last day of the NATO Advanced Study Institute on *Special functions 2000: present perspectives and future directions* (Tempe, Arizona, May 29 – June 9, 2000) there was a session on future directions, chaired by Richard Askey. Following is an attempt to summarize what has been said.

First Askey gave some *advice*.

- Ramanujan is still a very big source of future research, especially regarding congruences for the partition function. Exciting new results have been found by Ken Ono, but what has been found is probably only a hint of what else will be discovered.

- Other indications that there is still a lot to be learned from a study of Ramanujan is the recent work on elliptic functions with different bases, which was probably the first use of cubic transformations of hypergeometric functions, Ramanujan's wonderful series for $1/\pi$ and the remarkable identities found in the lost notebook (including results on mock theta functions).

- A second source of problems is in the work of David and Gregory Chudnovsky. They have mentioned many problems and results, some of which are eventually published, but many have not been published. Their papers are worth studying, although this is not easy.

- Work of Rodney Baxter lead to the discovery of quantum groups and was one of the sources for elliptic hypergeometric functions. There is much more there which needs to be understood.

- Bill Gosper has sent e-mail containing many interesting formulas to many people. Some e-mails have been understood, but many still are full of mysteries.

He then continued with some *safe predictions*:

- Special functions of several variables will be studied extensively (orthogonal polynomials, hypergeometric and basic hypergeometric functions, elliptic hypergeometric functions).
- Cubic transformations will get more attention (see, e.g., Bressoud's treatment of alternating sign matrices).
- There will be much more combinatorial work.
- Computer algebra will become important but will not replace thinking.
- Nonlinear equations and special functions (Painlevé) will receive more attention.
- Regarding asymptotics, there will be a deeper understanding in one variable, there will be much more on difference equations, and asymptotics for several variables will be developed more fully.

Askey then expressed some *hopes*:

- Specials functions in infinite dimensional spaces will appear.
- Linear differential equations with more than three regular singular points will be understood better than at present.
- Special functions over p-adic and finite fields become more popular.
- Orthogonal (and biorthogonal) rational functions will start to have more applications.
- Understanding mock theta functions via mock modular functions will partly succeed.
- The location of zeros of ${}_2F_1(a,b;c;z)$ on $(-\infty,0)$, $(0,1)$, and $(1,\infty)$ in the terminating case is known (also in the complex plane). We need extensions to ${}_3F_2$ and ${}_2\phi_1$ and other (basic) hypergeometric functions.

Finally Askey mentioned some *wild guesses*:

- Cubic transformations for hypergeometric functions really live in double series associated to G_2 and we are only seeing one dimensional parts of this.
- The function G satisfying the relation $G(x+1)=\Gamma(x)G(x)$ has an integral representation, probably an infinite dimensional one (a limit of Selberg's integral?).
- 9-j symbols as orthogonal polynomials in two variables can be represented as a double series.

Some other participants added some other interesting observations and suggestions for future work.

Tom Koornwinder:

- Matrix valued special functions. An obvious source of such functions are the generalized spherical functions associated with Riemannian symmetric pairs (G,K) and higher dimensional representations of K. See Grunbaum's lecture at this meeting for the example $(SU(3),SU(2))$.
- Orthogonal polynomials depending on noncommuting variables naturally occur in connection with quantum groups, see for instance the q-disk polynomials studied by Paul Floris, which are spherical functions for the quantum Gelfand pair $(U_q(n),U_q(n-1))$. More examples should be obtained and a general theory of such polynomials should be set up.
- Special functions associated with affine Lie algebras. Remarkable interpretations of special functions have already been found on affine Lie algebras (see the book by Victor Kac), but much more should be possible here. The lecture by Paul Terwilliger at this meeting gives some hints in this direction.
- The work of Borcherds: generalized Kac-Moody algebras, vertex algebras and lattices in relationship with automorphic functions.

- Algebraic and combinatorial techniques in contrast with analytic techniques have quickly gained importance in work on (q-)special functions during the last few decades. Algebra often gives rise to quick and easy formal proofs of, for instance, limit results. Usually, a rigorous analytic proof is much longer, while it does not give new insights. In fact, the rigorous proof is often omitted. There is need for a meta-theory which explains why formally obtained results are so often correct results.

Vyacheslav Spiridonov:

- It is likely that important special functions are hidden in some of the work on differential-delay and differential-difference equations.
- Development of elliptic special functions (elliptic beta integral, elliptic deformations of Painlevé).
- Connections of our work with other fields (biology, economy, etc.).
- Wavelets could be studied as special functions.
- Ismail's q-discriminant needs an interpretation in statistical mechanics.

Stephen Milne and Tom Koornwinder:

- The lecture by Jan Felipe van Diejen and the discussion after Stephen Milne's last lecture at this meeting made clear that several different types of multivariable analogues of one-variable (q-)hypergeometric series have been studied extensively, but that their mutual relationship is poorly understood. The three most important types are:

  1. Explicit series associated to classical root systems (Biedenharn, Gustafson, Milne),
  2. Heckdam-Opdam hypergeometric functions and Macdonald polynomials associated to any root system ((q-)differential equations, usually no explicit series),
  3. Gelfand hypergeometric functions (again (q-)differential equations, usually no explicit series).

  Van Diejen added in his lecture to this list:

  4. hypergeometric sums of q-Selberg type,
  5. hypergeometric sums coming from matrix inversion.

  Koornwinder would like to add:

  6. Solutions of KZ(B) ans q-KZ(B) equations (Knizhnik-Zamolodchikov(-Bernard))
  7. 3-j, 6-j and 9-j symbols for higher rank groups

  Elliptic generalizations of one and multivariable hypergeometric functions are also coming up now. Stephen Milne added that it is likely that the concept *very well poised* ties these various types of multivariable functions together.

- Applications in combinatorics and number theory are welcome.

Sergei Suslov:

- One needs to understand the classical q-functions, beginning with the q-exponential and q-trigonometric functions.
- Orthogonal q-functions (also the non-terminating series) and special limiting cases are useful.
- Biorthogonal rational functions are a rich source of research problems.

Mourad Ismail:

- There is still a lot of work to be done in moment problems and continued fractions, in particular indeterminate moment problems.
- Discriminants, lowering operators and electrostatics, such as the Coulomb gas model.
- Multivariate extensions.

Walter Van Assche: There is still quite some work in orthogonal polynomials:

- The asymptotic zero distribution and logarithmic potential theory (with external fields and constraints) has been worked out in quite some detail now. For some q-polynomials one seems to need circular symmetric weights. We don't know how to handle big q-Jacobi, big q-Laguerre, q-Hahn and q-Racah yet.
- There is a well established theory for strong asymptotics of orthogonal polynomials on the unit circle and on the interval $[-1, 1]$ (Szegő's theory). The analog of this theory for the infinite interval (e.g., Freud weights) is starting to become clear. So far there is no theory for orthogonal polynomials on a discrete set (such as the integers). The Riemann-Hilbert technique may be useful here.
- Multivariate orthogonal polynomials need more attention.
- Multiple orthogonal polynomials (one variable but several weights) may be a rich source of nice research. Some of these multiple orthogonal polynomials can be written in terms of nice special functions (generalized hypergeometric functions, hypergeometric functions of several variables, etc.). The analysis involves Riemann surfaces with several sheets, equilibrium problems for vector potentials, banded non-symmetric operators. We already know some nice applications in number theory and dynamical systems. Other applications would be nice.
- Higher order recurrence relations and asymptotics for solutions of difference equations are useful.

George Gasper: Positivity proofs and proofs that certain functions only have real zeros are very useful.

Erik Koelink:

- The ${}_8\phi_7$ basic hypergeometric is very nice and the multivariate case would be even nicer.
- Where do the elliptic hypergeometric functions of Frenkel and Turaev live?
- Is there a way to use Riemann-Hilbert problems for quantum groups?
- Applications of multivariate orthogonal polynomials in probability theory.

This is just a brief description and a personal account of what was said during the session on future directions. Some other participants added some open problems, but it would take too much space to report on these in the newsletter.

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Reports from Meetings and Conferences

1. 8th International Krawtchouk Conference, Kiev, Ukraine, May 11–14, 2000

The conference was organized by the Institute of Mathematics (National Academy of Sciences of the Ukraine), the Kiev National Shevchenko University, the National Drahomanov Pedagogical University and the National Technical University of the Ukraine (KPI). It took place in Kiev (Kyiv), the capital of the Ukraine.

The 626 participants represented Algeria, Armenia, Australia, Belarus, Italy, Kazakhstan, Lithuania, Russia, Ukraine and USA. Following tradition, the Conference included four sections: *Differential and integral equations, and applications*; *Algebra, geometry. Mathematical and numerical analysis*; *Theory of probability and mathematical statistics*; *History, methods of teaching of mathematics*.

The titles of the reports which are mostly relevant to orthogonal polynomials and special functions (organized "by functions") are:

- Savva V.A., Khlus O.V. *Krawtchouk Quantum Oscillator: Dynamics Features*.
- Groza V.A. *The Quantum Group $SU_q(2)$ and Product Formula for q-Krawtchouk Polynomials*.
- Zelenkov V.I. *Orthogonal Polynomials Given by Recurrence Relation*.
- Mamteev J.A., Huchraeva T.S., Burjacov A.N. *The Solution of a Contact Problem Using the Modified Struve and Bessel Functions*.
- Ivcina A.E., Huchraeva T.S., Stukalina V.I. *On Modified Struve Function and the Principal Characteristic*.
- Mamteev J.A., Stukalina V.I. *Modified Struve Function $L_\nu(z)$ and Struve Function $H_\nu(z)$*.

- Markova K.V. *Inversion Formula for Hankel Transform for a Class of Functions*.
- Gaidey V.O. *On Generalization of Bessel Function*.
- Bilyk Yu. *On Multiplication Theorem for Generalized Hypergeometric Functions*.
- Warren D., Seneta E. *Hypergeometric Polynomial Probability Generating Functions*.
- Nikitina O.M. *Finite Hybrid Integral Transforms of Mehler-Fock Type of the First Kind*.
- Romanenko N.V. *Fourier Series with Mathieu Functions*.
- Timan M.F. *On Fourier Series with Monotonic Coefficients*.
- Tretyakova N.N. *Limit Relations Between Some Integral Transforms*.
- Yakubovich S.B. *On the Titchmarsh Integral Transformation*.

The book of abstracts contains 560 pages.

As in the previous conferences the opening ceremony was dedicated to the memory of M. Krawtchouk. A memorial booklet *Son of the Sky* was presented by Galina Datsyuk and Mikola Soroka.

The second book published on the eve of the conference is the collection of Krawtchouk's popular scientific works. It includes in particular studies in the history of mathematics (e.g. *Euler's Influence on the further Development of Mathematics*), popular physical articles (*Space, Time, Matter*) scientific reports and lyrical notes about the author's travel to the World Mathematical Congress in Bologna and others. The book also contains the biography of M. Krawtchouk written by Prof. Nina Virchenko who has provided and inspired investigations of Krawtchouk's life and work for many years.

During the exciting tour of Kiev, the conference participants stood for a minute of silence near the newly opened memorial plaque on the house where M. Krawtchouk lived and where he was arrested on February 21, 1938.

The 9th Krawtchouk Conference will take place in 2002 — the 110th anniversary of the birth of M. Krawtchouk. All the necessary information will appear on the *Krawtchouk Polynomials Home Page* `http://www.isir.minsk.by/~zelenkov/physmath/kr_polyn`.

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2. Special Functions 2000: Current Perspective and Future Directions Arizona State University, Tempe, Arizona May 29 to June 9, 2000

Over 100 mathematicians gathered in Tempe to discuss Current Perspectives and Future Directions in the area of Special Functions. The meeting was remarkable from several different perspectives, perhaps the most striking feature being the diversity of areas in which talks were presented. The old maxim that "special functions are everywhere" gained considerable credibility as a variety of topics unfolded both in the main presentations and also during the parallel sessions. Orthogonal polynomials , special functions of one and several variables, asymptotics, continued fractions, applications to number theory, combinatorics and mathematical physics, integrable systems, harmonic analysis and quantum groups, Painleve classification were listed as some of the topics to be covered and that was no exaggeration–these and many others featured in a lively and well- organized program.

Many of the well-established masters in the area presented talks, mostly for two separate hours which facilitated more than just a glimpse of their ideas and expertise and attendance by graduate students was noteworthy. Richard Askey commented in his speech at the banquet that he was grateful to those present for carrying the banner of special functions forward over the past ten years and it was easy to see why he is pleased with developments in the field.

The venue was comfortable and suitable, the organizational details were taken care of in exemplary fashion and the power failure was thankfully short in duration, given the formidable heat in the desert at that time of year.

Congratulations are due to the organizers, the main speakers and to all those who attended. This was an extremely successful meeting and bodes very well for continuing vigorous interest in this area.

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It was hot. The sun was a terrifying presence. Your reporter would look out the window of the conference center and he could see for two miles down Apache Boulevard, and often not a single person could be seen in the open in this very modern city. Although the temperature of the air was over 100 F, nobody went into the swimming pool during the day because the temperature of the pool was above 90 F and the sun was so intense that it would give you skin cancer in five minutes. On the other hand it was not the hottest mathematical meeting that your reporter ever attended. I remember one epic meeting in Morocco in July when there was no air conditioning in the hotel, no water in the rest rooms, the temperature one day got up

to 130F, and all the lectures were in French.

By that standard, this meeting was a cake walk. The Holiday Inn was a very pleasant venue. There was so much air conditioning in the conference hall that most participants wore their jackets, the food was serviceable and easy to obtain, and the lay out of the conference with all lectures, food, and rooms in one location made it a very pleasant meeting. The weather kept all the participants in the motel, so that mathematical conversations were spontaneous and quite easy.

This was one of the most complex meetings that I have ever attended. It was concurrently: first, a NATO funded Advanced Study Institute, second, a NSF funded Research Conference, and third, a mini conference on Computer Algebra and Special Functions on the Web, supported by Wolfram Research and other sources. This may become the new paradigm for organizing a conference. The field of special functions has grown so enormously that it is difficult to remember the time when the few enthusiasts could easily fit into a small seminar room to discuss the problems of common interest. Now there is a cast of hundreds, working in dozens of areas. The specialty meetings now take on more of the character of the large national meetings.

And the total experience was quite enjoyable. The NATO funded Advanced Study Institute featured a number of hour long talks which were intended to introduce a topic, and bring a sophisticated audience up to a certain level of competence on a particular problem. For example, Luc Vinet gave two lectures entitled "Advances in multivariable special functions and mathematical physics", but actually he had the courage to ignore the physics, and work through several concrete examples of the new families of symmetric polynomials called atoms, related to the t-Kostka polynomials. The examples were carefully done, and the audience was very appreciative of the care with which they were explained. Two other speakers in this section that I really enjoyed were Christian Krattenthaler who gave a lovely series of lectures on plane partitions, orthogonal polynomials, and hypergeometric series. Christian certainly wins the prize for the most innovative use of the overhead projector in his presentations. Even if I did not enjoy the topic, I would be fascinated by his implementation of ur-animation in his talks. His screen reminds me of some of the early Loony Toons cartoons with the jerky but eye-catching animation. The other speaker was Alexander Kitaev, who introduced the audience to the six versions of the Painlevé equation and their solutions. I was very appreciative of his effort to explain to the outsider what was going on in this important area.

The NSF research Conference included many more traditional research type talks, from this feast of topics, I will mention two that I found particularly memorable: Yuan Xu talked about problems in Fourier expansions in several variables, and Khalifa Trimeche worked out the harmonic analysis associated with a singular differential-difference operator (a generalization of the Dunkl operator on the real line). There were many other excellent talks.

The final part of the conference were the sessions on computer algebra. These presentation occurred in the late afternoon and in the evening. It is a real indication of the interest in these topics (or perhaps just the weather) that even though the meetings started at 8:00am and went all day with only an hour for lunch and dinner, there would frequently be over one hundred people in the lecture hall at 9:00pm to hear Oleg Marichef or Michael Trott from Mathematica talk about their product, or Lance Littlejohn or Axel Riese talk about some new software that they had produced to simplify certain calculations. The wealth of computational tools now available is truly impressive. Many talks were given in many areas, and this brief note can only mention a few of them. On the other hand, I think it is important to try and see what the new tools or new areas where great progress is being made. I will mention three. First, it is quite clear from the talks of Dunkl, Xu, Littlejohn, Kill, Haine and others that finally a theory of multivariable polynomials is beginning to emerge. We may not agree on which of these polynomials to call classical, but we are beginning to see the clear lines of the theory. I look forward to the new book from Dunkl and Xu. Second, it was clear from the talks of Percy Deift and Walter Van Assche that the techniques developed to solve the Riemann-Hilbert problem are providing powerful new tools for the study of orthogonal polynomials. Finally, I have gone to many meeting and never heard mentioned the solutions of the Painlevé equation. Such solutions were not on everyone's lips at this meeting, but they were mentioned in at least five different talks, and they were the subject of two hours of plenary talks. We will hear much more about "the Painlevé Transcendents".

Finally we must thank the organizing committee: Bustoz, Ismail, Koornwinder, Spiridonov, Suslov, and Vinet for a splendid program, and the gracious hosts from Arizona State University, Sergi Suslov and Joaquin Bustoz for a wonderful scientific adventure in a very hot corner of the world. Hot mathematics in a hot place!

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Forthcoming Meetings and Conferences

1. 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 Non-

linear 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
- Gauss 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...)

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

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

Dedicated to José Javier Guadalupe

Final 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 that 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).

This summer school is dedicated to our colleague and friend José Javier Guadalupe (Chicho) who unfortunately died this past April 1 in a car accident. Chicho was a very active researcher in analysis, in particular in the fields of orthogonal polynomials and Fourier series, among others. (See the memorial note at the beginning of this issue.)

Registration: The registration is 20.000 PTS. This price does not include the Hotel and/or meals. The deadline is July 21, 2000. For further information please visit the WWW page `http://merlin.us.es/~renato/laredo/`

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/OS 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`). More detailed information can be obtained in the WWW page `http://merlin.us.es/~renato/laredo/`

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3. 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$300.

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: R. Askey (USA), P. L. Butzer (Germany), M. Ismail (USA), P. Shiue (USA), L. 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:

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Remarks:

- This conference will be held at the Dalian University of Technology, Dalian, China, from August 5 to 8, 2000. For information about the University 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 the following information as soon as possible, which is necessary to apply for a 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
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4. 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. Moody (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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5. 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), Biancamaria 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, Johannesbourg, 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; 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)

6. q-Series with Applications to Combinatorics, Number Theory and Physics. University of Illinois at Urbana-Champaign, October 26-28, 2000

Confirmed Plenary Speakers:

- Scott Ahlgren (Colgate University)
- George Andrews (Penn State University)
- Richard Askey (University of Wisconsin)
- Anne Schilling (MIT)
- Dennis Stanton (University of Minnesota)

Special Note:

Some of the plenary lectures will highlight open problems and future trends.

Confirmed Invited Speakers:

- Krishnaswami Alladi (University of Florida)
- Douglas Bowman (University of Illinois)
- Thomas Ernst (Uppsala University)
- Mourad Ismail (University of South Florida)
- Christian Krattenthaler (University of Vienna)
- Jeremy Lovejoy (University of Wisconsin)
- John McKay (Concordia University)
- Steve Milne (Ohio State University)
- Katsuhisa Mimachi (Kyushu University)
- Morris Newman (University of California, Santa Barbara)
- Peter Paule (University of Linz)-tentative
- Sasha Polishchuk (Boston University)
- Mizan Rahman (Carleton University)
- Ole Warnaar (University of Amsterdam)-tentative
- Sander Zwegers (University of Utrecht)

Schedule of Events

- October 26, 2000 Conference Banquet (site to be determined)
- October 27, 2000 Concert by C. Krattenthaler (Levis Faculty Center)
- October 28, 2000 Party (Home of Bruce and Helen Berndt).

Registration:

Registration information will be available soon. To be placed in an e-mail list, send an e-mail to `berndt@math.uiuc.edu`

Conference Proceedings:

We might publish a proceedings of this conference. Papers must be submitted by January 1, 2001.

Funding:

Due to generous support from the David and Lucile Packard Foundation, the National Science Foundation and the Number Theory Foundation, financial support is available to a limited number of participants with some preference given to graduate students and new PhD's. To apply for this support, send e-mail to `ono@math.wisc.edu` by September 1, 2000.

Scientific Organizers:

Bruce Berndt and Ken Ono

Rafael J. Yáñez
(ryanez@ugr.es)

7. Second Announcement of the 4th International Interdisciplinary Meetingon "Symmetries and Integrability of Difference Equations", Tokyo (Japan), November 27-December 1, 2000

The SIDE meetings are intended to provide a point of contact between researchers of various disciplines, all working or using methods from discrete systems, i.e. systems that can be described by ordinary or partial difference equations. This domain forms the core of a great variety of fields, including classical and quantum physics, computer science, mathematical biology, economics, numerical analysis, discrete geometry, and so on.

The main topics of the present meeting will be: Integrable difference equations, symmetries of ordinary and partial difference equations, cellular automata, discrete monodromy problems, $q-$special functions, discrete geometry, applications to physics and engineering.

In this meeting, lectures will be delivered in the auditorium of the Graduate School of Mathematical Sciences, University of Tokyo. (Information is available on `http://liaison.ms.u-tokyo.ac.jp/`) Since our idea is to keep to a single session format, we plan to accept only a restricted number of applications. All of the talks will be from 20 to 30 minutes long. We will also organize poster sessions.

The cost of participation consists of a registration fee (including excursion and banquet) of 15,000 Yen. As for the accommodation, we are happy to provide reservations in the hotel:

HILPORT HOTEL
Sakuraoka-cho 23-19, Shibuya-ku, Tokyo 150-0031, Japan
Tel. (+81)3-3462-5171 Fax. (+81)3-3496-2066

at the price of 12,000 Yen (all inclusive, i.e. breakfast, lunch and dinner) or 9,500 Yen (with breakfast only) per day.

Invited speakers:

- M. Ablowitz (U. Colorado-USA)
- V. Adler (UFA-Russia)
- C. Brezinski (U. Lille-France)
- A. Doliwa (Warsaw U.-Poland)
- C. Gilson (U. Glasgow-UK)
- V. Gromak (Belarus State U.- Belarus)
- X. Hu (Academia Sinica-China)
- R. Kashaev (Steklov Math Institute, St. Petersburg-Russia)
- B. Konopelchenko (U. di Lecce-Italy)
- D. Levi (U. di Roma Tre-Italy)
- S. Leble (Technical U. of Gdańsk, Poland)
- S. Ruijsenaars (CRM, Amsterdam-Netherlands)
- W. Schief (U. New South Wales-Australia)
- S. Sergeev (Protvino-Russia)
- E. Sklyaninin (Steklov Math. Institute, St. Petersburg-Russia)
- Yu. Suris (U. Bremen-Germany)
- W. Van Assche (U. Leuven-Belgium)
- P. Winternitz (U. de Montreal-Canada)

Organizing committee:

- M. Toda (honorary chairperson)
- J. Satsuma (chairperson, U. Tokyo-Japan)
- B. Grammaticos (Paris VII-France)
- J. Hietarinta (U. Turku-Finland)
- N. Joshi(U. Adelaide-Australia)
- F. Nijhoff (U. Leeds-UK)
- J. Nimmo (U. Glasgow-UK)
- D. Takahashi (U. Waseda-Japan)
- T. Tokihiro (U. Tokyo-Japan)
- R. Willox (U. Tokyo-Japan & VU. Brussel-Belgium)

Scientific committee:

- R. Hirota (honorary chairperson, U. Waseda-Japan)
- K. Okamoto (chairperson, U. Tokyo-Japan)
- L. Faddeev (Steklov Math. Institut, St. Petersburg-Russia)
- M. Jimbo (U. Kyoto-Japan)
- K. Kajiwara (U. Doshisha-Japan)
- M. Kruskal (U. Rutgers-USA)
- D. Levi (U. Roma Tre-Italy)

- A. Nagai (U. Osaka-Japan)Y
- Y. Nakamura (U. Osaka-Japan)
- V. Papageourgiou (U. Patras-Greece)
- A. Ramani (Ecole Polytechnique-France)
- C. Viallet (Paris VI-France)
- P. Winternitz (U. Montreal-Canada)

Local organizing committee:

J. Satsuma, T. Tokihiro
Graduate School of Mathematical Sciences,
University of Tokyo,
3-8-1 Komaba, Meguro-ku,
Tokyo 153-8914, Japan
e-mail: satsuma@poisson.ms.u-tokyo.ac.jp
toki@poisson.ms.u-tokyo.ac.jp
fax: +81-3-5465-8312

If you are interested in attending, please visit the web site:

http://elrond.doshisha.ac.jp/side4/index.html

where you can find the application form which should be sent to us. Information updates will be available on this web site.

J. Satsuma
(satsuma@poisson.ms.u-tokyo.ac.jp)
T. Tokihiro
(toki@poisson.ms.u-tokyo.ac.jp)

8. Workshop on Quasiclassical and Quantum Structures. Fields Institute Toronto, Ontario, Canada, January 9-14, 2001.

Organizers: Pavel Etingof, Massachusetts Institute of Technology Boris Khesin, University of Toronto

Topics include:

- Classical and quantum integrable systems
- Macdonald theory
- Poisson-Lie groups, quantum groups, dynamical quantum groups, and quantization
- Infinite-dimensional Lie algebras and structures, and their quantum deformations
- $q-$Virasoro, $q-$W-algebras and their quasiclassical limits, affine and quantum affine algebras at the critical level
- Quantization of Poisson manifolds
- Hypergeometric and q-hypergeometric functions, their generalizations, KZ, qKZ, KZB, qKZB equations, Elliptic quantum groups

Limited funds may be available to assist graduate students and postdoctoral participants. Please contact the organizers by fax at: (416) 348-9759, or through e-mail at: lt-structure@fields.utoronto.ca

All are welcome.

This Workshop is part of the "Infinite-dimensional Lie Theory and its Applications" and "Symplectic Geometry, Topology, and Gauge Theory" programs, both hosted by the Fields Institute in Fall 2000 and Spring 2001, respectively.

Contact mailing address:
c/o Lie Theory, The Fields Institute 222 College Street, Toronto, Ontario M5T 3J1 Telephone: (416) 348-9710 Fax: (416) 348-9759

9. Sixth International Symposium on Orthogonal Polynomials, Special Functions and Applications, Rome (Italy), June 18-22, 2001.

Dear colleagues,

The sixth international Symposium on Orthogonal Polynomials, Special Functions and their Applications will be held on June 18 - 22, 2001 in Roma (Italy).

The 6th OPSFA follows the European Conferences of Bar-Le-Duc (France, 1984), Segovia (Spain, 1986), Erice (Italy, 1990), Granada (Spain, 1991, VII SPOA), Evian (France, 1992), Delft (Holland, 1994, in honour of Thomas Jan Stieltjes Jr. (1856-1894)), Sevilla (Spain, 1997, VIII SPOA) and Patra (Greece, 1999, in honour of Theodore Chihara).

The scientific program is currently being elaborated by the scientific committee: A. Laforgia (Universitá Roma Tre, Italy), P. E. Ricci (Universitá "La Sapienza", Roma, Italy), M. De Bruin (University of Delft, Netherlands), F. Marcellan (Universidad Carlos III, Madrid, Spain), P. D. Siafarikas (University of Patras, Greece), M. Muldoon (York University, Canada), R. Wong (City University of Hong Kong, China). It will consist, as usual, of some plenary lectures and short communications (20 minutes). The second circular, to be distributed in autumn 2000, will give more information about it.

The cost of attendance is expected to be quite reasonable. The registration fee will be around 250 Euros, which includes the admission to the Symposium, a copy of the book of abstracts, a copy of the Proceedings, reception and participation in some social events (welcome drink,

visit to Rome's surroundings, etc.).

More details about accommodation, travelling expenses and transportation of the participants from the airport will be given in the next circulars.

Mailing address:

Sixth International Symposium on Orthogonal Polynomials, Special Functions and their Applications.
Dipartimento di Matematica (to prof. Andrea LAFORGIA)
Universitá Roma Tre
Largo S. Leonardo Murialdo, 1
00146 ROMA (Italy)
tel. +39+06+54888025, 54888008; fax 54888072.

NOTICE: You may also send the preregistration form via e-mail; please see the Web page `www.mat.uniroma3.it/opsfa2001` . You may also use the e-mail address of the Symposium `opsfa2001@mat.uniroma3.it` or the e-mail addresses of the members of the local organizing committee:

- Prof. Andrea Laforgia: `laforgia@mat.uniroma3.it`
- Prof. Paolo Emilio Ricci: `riccip@.uniroma1.it`
- Dott. Pierpaolo Natalini: `natalini@mat.uniroma3.it`
- Dott.ssa Silvia Noschese: `noschese@uniroma1.it`
- Dott. Biagio Palumbo: `palumbo@mat.uniroma3.it`

Please bring this announcement to the attention of interested people.

Looking forward to seeing you in Roma

Andrea Laforgia
(laforgia@mat.uniroma3.it)

10. First Announcement: 2001: A Mathematics Odyssey. A conference on the analytic theory of continued fractions, orthogonal functions, rational approximation and related topics. Grand Junction (Colorado, USA), August 6-10, 2001.

A celebration of the 70th birthday of Dr. William B. Jones Professor Emeritus University of Colorado, Boulder, USA

In recognition of the contributions Professor William B. Jones has made to the field of continued fractions and rational approximation, we are pleased to announce a conference organized in his honor. The conference will be held August 6-10, 2001, at Mesa State College in Grand Junction, Colorado, USA. We invite contributions from both the theoretical and computational aspects of continued fractions, orthogonal polynomials, rational approximation, and related areas and applications.

There is no need to commit to attending the conference at this time. However, if you are interested in receiving a second announcement and would like to be on our mailing list, please respond or email to one of the organizers at the address below, including your name, mailing address and email address.

More information about Mesa State College and Grand Junction, Colorado, can be found at `http://www.mesastate.edu`, and `http://www2.mesastate.edu/community_links.htm`.

We hope to see you there.

Organizers:
Cathy Bonan-Hamada, Phil Gustafson
Mathematics Department
Mesa State College
1100 North Ave.
Grand Junction, CO
81501-3122 USA

Cathy Bonan-Hamada
(cbonan@mesastate.edu)
Phil Gustafson
(pgustafs@mesastate.edu)

11. International Conference on "NUMERICAL ALGORITHMS" dedicated to Claude Brezinski on the occasion of his 60th birthday. Marrakesh (Morocco), October 1-5, 2001

We intend to organize an international conference in October 2001 to celebrate the 60th birthday of Claude Brezinski and, at the same time, the 10th anniversary of the journal Numerical Algorithms that he founded in 1991 and where contributed papers will be published. The themes of the conference will cover all aspects of Numerical Analysis, in particular those which are related to numerical algorithms. The goal of this conference is to bring together experts from these areas. The numerical analysis community is warmly invited to attend so that we have a valuable scientific meeting and celebrate Claude's 60th birthday at the banquet.

Participants will be accommodated in a 4-star hotel, comparable to the best European or American hotels, at a special reduced price. In Marrakesh, the weather is very nice in October and the town can be easily reached by plane from Casablanca (one hour). Casablanca has direct connections to major European cities and to New York and Montreal.

A web site containing all the informations about this conference can be found at `http://www-lma.univ-littoral.fr/~na2001`

If you are interested in participating, please

notify us as soon as possible at the address `na2001@lma.univ-littoral.fr`

In this way, you will regularly receive new updated informations about this event.

Organizing committee:

- B. Beckermann (University of Lille I, France)
- A. Bentbib (Faculty of Sciences and Technologies, Marrakesh, Morocco)
- B. Germain-Bonne (University of Lille I, France)
- J.-P. Chehab (University of Lille I, France)
- M. El Alaoui-Talibi (Faculty of Sciences Semlalia, Marrakesh, Morocco)
- A. Fdil (ENS, Marrakesh, Morocco)
- A. Lembarki (Faculty of Sciences Semlalia, Marrakesh, Morocco)
- M. Prevost (University of Littoral, Calais, France)
- A. Matos (University of Lille I, France)
- A. Messaoudi (ENS, Rabat, Morocco)
- M. Redivo-Zaglia (University of Calabria, Cosenza, Italy)
- R. Sadaka (ENS, Rabat, Morocco)
- H. Sadok (University of Littoral, Calais, France)
- J. Van Iseghem (University of Lille I, France)

Future Planning

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.

- 2001.
  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.
- Mourad Ismail and Roderick Wong have plans for a summer school in Hong Kong. Contact Mourad Ismail (ismail@math.usf.edu).

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

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.CO/0001082
   Title: *Une identite remarquable en theorie des partitions*
   Authors: Alain Lascoux, Michel Lassalle (CNRS,Paris)
   Categories: CO Combinatorics
   Comments: 16 pages, LaTeX, in French

   Abstract: We prove an identity about partitions, previously conjectured in the study of shifted Jack polynomials (math.CO/9903020). The proof given is using λ-ring techniques. It would be interesting to obtain a bijective proof.

2. E-print math.CO/0001078
   Title: *A Probabilistic Proof of the Rogers Ramanujan Identities*
   Author: Jason Fulman
   Categories: CO Combinatorics (CT Category Theory; NT Number Theory)

   Abstract: The asymptotic probability theory of conjugacy classes of the finite general linear and unitary groups leads to a probability measure on the set of all partitions of natural numbers. A simple method of understanding these measures in terms of Markov chains is given and compared with work on the uniform measure. Elementary probabilistic proofs of the

Rogers-Ramanujan identities follow. As a corollary, the main case of Bailey's lemma is interpreted as finding eigenvectors of the transition matrix of the Markov chain. It is shown that the viewpoint of Markov chains extends to quivers.

3. E-print math.QA/0001114
Title: *Fermionic formulas for level-restricted generalized Kostka polynomials and coset branching functions*
Authors: Anne Schilling, Mark Shimozono
Categories: QA Quantum Algebra (CO Combinatorics)
Math Subject Class: 05A19; 05A15; 17B65; 17B37; 81R50; 82B23
Comments: 67 pages, axodraw style file needed

Abstract: Level-restricted paths play an important role in crystal theory. They correspond to certain highest weight vectors of modules of quantum affine algebras. We show that the recently established bijection between Littlewood–Richardson tableaux and rigged configurations is well-behaved with respect to level-restriction and give an explicit characterization of level-restricted rigged configurations. As a consequence a new general fermionic formula for the level-restricted generalized Kostka polynomial is obtained. Some coset branching functions of type A are computed by taking limits of these fermionic formulas.

4. E-print math.QA/0001006
Title: *Summation and transformation formulas for elliptic hypergeometric series* Author: S. O. Warnaar
Categories: QA Quantum Algebra (CO Combinatorics)
Math Subject Class: Primary 33D15, 33D67, 33E05; Secondary 05A30
Report number: ITF-99-42
Comments: 21 pages, AMS-LaTeX

Abstract: Using matrix inversion and determinant evaluation techniques we prove several summation and transformation formulas for terminating, balanced, very-well-poised, elliptic hypergeometric series.

5. E-print math.QA/0002090
Title: *Koornwinder polynomials and affine Hecke algebras* Author: J. V. Stokman
Categories: QA Quantum Algebra (RT Representation Theory)
Math Subject Class: 33D52; 33D80
Comments: 30 pages

Abstract: In this paper we derive the biorthogonality relations, diagonal term evaluations and evaluation formulas for the non-symmetric Koornwinder polynomials. For the derivation we use certain representations of the (double) affine Hecke algebra which were originally defined by Noumi and Sahi. We furthermore give the explicit connection between the non-symmetric and the symmetric theory. This leads in particular to new proofs of the orthogonality relations, quadratic norm evaluations and evaluation formulas for the symmetric Koornwinder polynomials.

6. E-print math.QA/0001184
Title: *Differential Equations Compatible with KZ Equations*
Authors: G. Felder, Y. Markov, V. Tarasov, A. Varchenko
Categories: QA Quantum Algebra
Math Subject Class: 35Q40; 17B10; 17B56; 81R10; 33C80
Comments: 34 pages, LaTeX

Abstract: We define a system of "dynamical" differential equations compatible with the KZ differential equations. The KZ differential equations are associated to a complex simple Lie algebra $\mathbf{g}$. These are equations on a function of n complex variables z_i taking values in the tensor product of n finite dimensional $\mathbf{g}$-modules. The KZ equations depend on the "dual" variable in the Cartan subalgebra of $\mathbf{g}$. The dynamical differential equations are differential equations with respect to the dual variable. We prove that the standard hypergeometric solutions of the KZ equations also satisfy the dynamical equations. As an application we give a new determinant formula for the coordinates of a basis of hypergeometric solutions.

7. Nonlinear Sciences, abstract nlin.SI/0001001
Title: *Fermionic representation for basic hypergeometric functions related to Schur polynomials*
Authors: A.Yu.Orlov, D.M.Scherbin
Comments: 17 pages,LaTeX, no figures, misprints are corrected
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. Multivariate 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.

8. Astrophysics, abstract astro-ph/0001279

Title: *The Fractional Kinetic Equation and Thermonuclear Functions*
Authors: H.J. Haubold (UN, Austria), A.M. Mathai (McGill University, Canada)
Comments: 14 pages, LaTeX

Abstract: The paper discusses the solution of a simple kinetic equation of the type used for the computation of the change of the chemical composition in stars like the Sun. Starting from the standard form of the kinetic equation it is generalized to a fractional kinetic equation and its solutions in terms of H-functions are obtained. The role of thermonuclear functions, which are also represented in terms of G- and H-functions, in such a fractional kinetic equation is emphasized. Results contained in this paper are related to recent investigations of possible astrophysical solutions of the solar neutrino problem.

9. Astrophysics, abstract astro-ph/0001280
Title: *Analytical Study of Thermonuclear Reaction Probability Integrals*
Authors: M.A. Chaudhry (King Fahd University, Saudi Arabia), H.J. Haubold (UN, Austria), A.M. Mathai(McGill University, Canada)
Comments: 12 pages, LaTeX

Abstract: An analytic study of the reaction probability integrals corresponding to the various forms of the slowly varying cross-section factor $S(E)$ is attempted. Exact expressions for reaction probability integrals are expressed in terms of the extended gamma functions.

10. E-print math.CA/0002226
Title: *Orthogonal Polynomials and Generalized Oscillator Algebras*
Author: V. V. Borzov (U. of Telecommunications, St.Petersburg)
Categories: CA Classical Analysis (QA Quantum Algebra)
Math Subject Class: 33C45, 33C80, 33D45, 33D80
Comments: 23 pages, no figures, submitted to Integral Transforms and Special Functions

Abstract: For any orthogonal polynomials system on real line we construct an appropriate oscillator algebra such that the polynomials make up the eigenfunctions system of the oscillator hamiltonian. The general scheme is divided into two types: a symmetric scheme and a non-symmetric scheme. The general approach is illustrated by the examples of the classical orthogonal polynomials: Hermite, Jacobi and Laguerre polynomials. For these polynomials we obtain the explicit form of the hamiltonians, the energy levels and the explicit form of the impulse operators.

11. 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, 23 pages. Formalism of general discrete integrable operators has been added

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 discrete analogs of a Riemann-Hilbert problem and of an integrable integral operator and show that computing the resolvent of a discrete integrable operator can be reduced to solving a corresponding discrete Riemann-Hilbert problem. 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.

12. math.CA/0004053
Title: *The Askey-Wilson function transform*
Author: Erik Koelink, Jasper V. Stokman
Categories: CA Classical Analysis (QA Quantum Algebra; RT Representation Theory)
Math Subject Class: 33D45, 44A20, 33D80, 44A60
Comments: LaTeX2e file. 19 pages

Abstract: In this paper we present an explicit (rank one) function transform which contains several Jacobi-type function transforms and Hankel-type transforms as degenerate cases. The kernel of the transform, which is given explicitly in terms of basic hypergeometric series, thus generalizes the Jacobi function as well as the Bessel function. The kernel is named the Askey-Wilson function, since it provides an analytical continuation of the Askey-Wilson polynomial in its degree. In this paper we establish the L^2-theory of the Askey-Wilson function transform, and we explicitly determine its inversion formula.

13. math.CA/0004001
Title: *An asymptotic expansion for a ratio of products of gamma functions*
Author: Wolfgang Buehring
Categories: CA Classical Analysis
Math Subject Class: 33B15
Comments: 8 pages
Abstract: An asymptotic expansion of a ratio of products of gamma functions is derived. It generalizes a formula which was stated by Dingle, first proved by Paris, and recently reconsidered by Olver.

14. math.CO/0005008
Title: *On the Asymptotics of Takeuchi Numbers*
Author: Thomas Prellberg
Categories: CO Combinatorics (CA Classical Analysis)
Math Subject Class: 05A16
Comments: latex file with 13 pages, 2 postscript figures included

Abstract: I present an asymptotic formula for the Takeuchi numbers T_n. In particular, I give compelling numerical evidence and present a heuristic argument showing that

$$T_n \sim C_T B_n \exp \frac{1}{2} W(n)^2$$

as n tends to infinity, where B_n are the Bell numbers, W(n) is Lambert's W function, and $C_T = 2.239...$ is a constant. Moreover, I show that the method presented here can be generalized to derive conjectures for related problems.

15. math.CV/0005032
Title: *Simultaneous approximation and interpolation of functions on continua in the complex plane*
Authors: V. V. Andrievskii, I. E. Pritsker, R. S. Varga
Categories: CV Complex Variables (CA Classical Analysis)
Math Subject Class: 30E10, 41A10
Comments: 21 page; submitted to J. Math. Pures Appl

Abstract: We construct polynomial approximations of Dzjadyk type (in terms of the k-th modulus of continuity, $k \geq 1$) for analytic functions defined on a continuum E in the complex plane, which simultaneously interpolate at given points of E. Furthermore, the error in this approximation is decaying as $e^{-cn^{\alpha}}$ strictly inside E, where c and α are positive constants independent of the degree n of the approximating polynomial.

16. math.QA/0005123
Title: *Refined q-trinomial coefficients and character identities*
Author: S. Ole Warnaar
Categories: QA Quantum Algebra (CO Combinatorics)
Math Subject Class: 05A10;05A30;17B68
Report number: ITFA 2000-10
Comments: 17 pages, 1 figure, submitted to the proceedings of The Baxter Revolution in Mathematical Physics

Abstract: A refinement of the q-trinomial coefficients is introduced, which has a very powerful iterative property. This "T-invariance" is applied to derive new Virasoro character identities related to the exceptional simply-laced Lie algebras E_6,E_7 and E_8.

17. math.QA/0006006
Title: *Pieri-type formulas for the non-symmetric Jack polynomials*
Author: P. J. Forrester, D. S. McAnally
Categories: QA Quantum Algebra
Comments: 19 pages

Abstract: In the theory of symmetric Jack polynomials the coefficients in the expansion of the pth elementary symmetric function $e_p(z)$ times a Jack polynomial expressed as a series in Jack polynomials are known explicitly. Here analogues of this result for the non-symmetric Jack polynomials $E_\eta(z)$ are explored. Necessary conditions for non-zero coefficients in the expansion of $e_p(z)E_\eta(z)$ as a series in non-symmetric Jack polynomials are given. A known expansion formula for $z_i E_\eta(z)$ is rederived by an induction procedure, and this expansion is used to deduce the corresponding result for the expansion of $\prod_{j=1,j\neq i}^{N} z_j E_\eta(z)$, and consequently the expansion of $e_{N-1}(z)E_\eta(z)$. In the general p case the coefficients for special terms in the expansion are presented.

18. hep-th/0004153
Title: *Central Binomial Sums, Multiple Clausen Values and Zeta Values* Authors: J. M. Borwein, D. J. Broadhurst, J. Kamnitzer
Categories: (CA Classical Analysis)
Report number: OUT–4102–88, CECM 99:137
Comments: 17 pages, LaTeX, with use of amsmath and amssymb packages, to appear in Journal of Experimental Mathematics

Abstract: We find and prove relationships between Riemann zeta values and central binomial sums. We also investigate alternating binomial sums (also called Apéry sums). The study of non-alternating sums leads to an investigation of different types of sums which we call multiple Clausen values. The study of alternating sums leads to a tower of experimental results involving polylogarithms in the golden ratio. In the non-alternating case, there is a strong connection to polylogarithms of the sixth root of unity, encountered in the 3-loop Feynman diagrams of `hep-th/9803091` and subsequently in hep-ph/9910223, hep-ph/9910224, cond-mat/9911452 and hep-th/0004010.

19. math.CA/0003148
Title: *Second-order linear differential equations with two irregular singular points of rank three: the*

characteristic exponent
Author: Wolfgang Buehring
Categories: CA Classical Analysis
Math Subject Class: 34A20; 34A25; 34A30
Comments: 33 pages

Abstract: For a second-order linear differential equation with two irregular singular points of rank three, multiple Laplace-type contour integral solutions are considered. An explicit formula in terms of the Stokes multipliers is derived for the characteristic exponent of the multiplicative solutions. The Stokes multipliers are represented by converging series with terms for which limit formulas as well as more detailed asymptotic expansions are available. Here certain new, recursively known coefficients enter, which are closely related to but different from the coefficients of the formal solutions at one of the irregular singular points of the differential equation. The coefficients of the formal solutions then appear as finite sums over subsets of the new coefficients. As a by-product, the leading exponential terms of the asymptotic behaviour of the late coefficients of the formal solutions are given, and this is a concrete example of the structural results obtained by Immink in a more general setting. The formulas displayed in this paper are not of merely theoretical interest, but they also are complete in the sense that they could be (and have been) implemented for computing accurate numerical values of the characteristic exponent, although the computational load is not small and increases with the rank of the singular point under consideration.

20. math.CV/0003175
Title: **On zeros of polynomials orthogonal over a convex domain**
Authors: V. V. Andrievskii, I. E. Pritsker, R. S. Varga
Categories: CV Complex Variables (CA Classical Analysis)
Math Subject Class: 30C10, 30C15, 30C85, 41A10
Comments: 24 pages; to appear in Constr. Approx

Abstract: We establish a discrepancy theorem for signed measures, with a given positive part, which are supported on an arbitrary convex curve. As a main application, we obtain a result concerning the distribution of zeros of polynomials orthogonal on a convex domain.

21. math-ph/0003005
Title: *Discrete phase integral method for five-term recursion relations*
Author: Anupam Garg
Categories: MP Mathematical Physics (CA Classical Analysis)
Comments: Revtex; 7 ps figures

Abstract: A formalism is developed to study certain five-term recursion relations by discrete phase integral (or Wentzel-Kramers-Brillouin) methods. Such recursion relations arise naturally in the study of the Schrodinger equation for certain spin Hamiltonians. The conditions for the validity of the phase integral approximation are derived. It is shown that in contrast to the three-term problem, it is now possible to get a turning points "under the barrier", i.e., in the classically forbidden region, as well as inside the classically allowed region. Further, no qualitatively new types of turning points arise in recursion relations with still higher numbers of terms. The phase integral approximation breaks down at the new turning points, requiring new connection formulas, which are derived.

22. math.CO/9907183
Title: *On Multi-color partitions and the generalized Rogers-Ramanujan identities*
Authors: Naihuan Jing, Kailash Misra, Carla Savage
Categories: CO Combinatorics (QA Quantum Algebra)
Comments: Latex2e, corrected version

Abstract: Basil Gordon, in the sixties, and George Andrews, in the seventies, generalized the Rogers-Ramanujan identities to higher moduli. These identities arise in many areas of mathematics and mathematical physics. One of these areas is representation theory of the infinite dimensional Lie algebra, where various known interpretations of these identities have led to interesting applications. Motivated by their connections with Lie algebra representation theory, we give a new interpretation of the product side of generalized Rogers-Ramanujan identities in terms of multi-color partitions.

23. math.CO/0004019
Title: *Une q - spécialisation pour les fonctions symétriques monomiales*
Author: Michel Lassalle (CNRS,Paris)
Categories: CO Combinatorics
Comments: 25 pages, LaTeX, in French. Enlarged version, with new remarks, misprints corrected, and an Appendix added

Abstract: We obtain the specialization of monomial symmetric functions on the alphabet (a-b)/(1-q). This gives a remarkable algebraic identity, and four new developments for the Macdonald polynomial associated with a row. The proofs are given in the framework of λ-ring theory.

24. math.CO/0004012
Title: *Schur's old determinant proves a brand-new theorem of Garrett-Ismail-Stanton*
Author: Helmut Prodinger
Categories: CO Combinatorics
Math Subject Class: 05A30

Abstract: Garrett, Ismail, and Stanton gave a general formula that contains the Rogers-Ramanujan identities as special cases. We show how easy this is when using a determinant that Schur introduced in 1917.

25. math.CA/0005095
Title: *A generalization of Kummer's identity*
Author: Raimundas Vidunas
Categories: CA Classical Analysis
Math Subject Class: 33C05, 39A10
Comments: 6 pages

Abstract: The well-known Kummer's formula evaluates the hypergeometric series ${}_2F_1(A,B;C;-1)$ when the relation $B-A+C=1$ holds. In this paper a formula is presented which evaluates this series in case when $B-A+C$ is an integer. The formula expresses the infinite series as a linear combination of two Γ-terms with coefficients being finite hypergeometric ${}_3F_2$ series. Algorithmical problems of summation of infinite hypergeometric series are considered in the light of the generalized formula.

26. math.QA/0005071
Title: T*he q-twisted cohomology and the q-hypergeometric function at /q/=1*
Author: Yoshihiro Takeyama
Categories: QA Quantum Algebra (CA Classical Analysis)
Comments: 16 pages

Abstract: We construct the q-twisted cohomology associated with the q-multiplicative function of Jordan-Pochhammer type at |q|=1. In this framework, we prove the Heine's relations and a connection formula for the q-hypergeometric function of the Barnes type. We also prove an orthogonality relation of the q-little Jacobi polynomials at |q|=1.

27. math-ph/0004028
Title: *On the use of Mellin transform to a class of q-difference-differential equations*
Author: Choon-Lin Ho (Tamkang University, Taiwan)
Categories: MP Mathematical Physics (QA Quantum Algebra)
Journal reference: Phys. Lett. 268A (2000) 217
Comments: 13 pages, LaTex, no figures

Abstract: We explore the possibility of using the method of classical integral transforms to solve a class of q-difference-differential equations. The Laplace and the Mellin transform of q-derivatives are derived. The results show that the Mellin transform of the q-derivative resembles most closely the corresponding expression in classical analysis, and it could therefore be useful in solving certain q-difference equations.

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 $L^p(\mathbf{T})$, $1 \le p \le \infty$, i.e., for polynomial f

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

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

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

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],

$$\Big(\int_0^\pi \Big| \sum m_{k+j} \, a_k \, P_k^{(\alpha,\beta)}(\cos\theta) \Big|^p \sin^{2\alpha+1}\frac{\theta}{2} \cos^{2\beta+1}\frac{\theta}{2} \, d\theta \Big)^{1/p}$$

$$\equiv \Big(\int_0^\pi \Big| \sum m_{k+j} \, b_k \, \phi_k^{(\alpha,\beta)}(\cos\theta) \Big|^p w_{\alpha,\beta,p}(\theta) \, d\theta \Big)^{1/p}$$

$$\approx \Big(\int_0^\pi \Big| \sum m_{k+j} \, b_k \, \cos k\theta \Big|^p w_{\alpha,\beta,p}(\theta) \, d\theta \Big)^{1/p},$$

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

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

(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

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

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):

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

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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Miscellaneous

1. SIAM Reaches Out to Applied Mathematicians In Developing Countries

NOTE: Column appeared in SIAM News, Volume 33, number 1. Reproduced with permission of SIAM and Gilbert Strang.

I am writing this month [January 2000] with good news for the growth of SIAM. The SIAM Board of Trustees has approved a proposal to establish annual dues of $25 for members who live and work in developing countries. A long list of eligible countries can be found on our Web site (`http://www.siam.org/membership/outreachlist.htm`), along with the application form (`https://www.siam.org/membership/outreachmem.htm`). I would like to write about the reasons for this important step. And I need to ask your help in making this new opportunity known beyond the readership of SIAM News.

The mission of SIAM is to help applied mathematicians do their work. Our journals and conferences are a terrific communication link—a way to learn about the work of others and to announce new results. We all share in this effort, each doing some part of it, and the more who are involved the better. This sharing has to be open to the widest possible number of mathematicians and scientists and engineers. We want to welcome everyone who supports the goals of SIAM.

SIAM's $99 annual dues are very modest compared with those of other major scientific and engineering societies. We also maintain low prices for books and journals, always with the same purpose: We need those publications to do our work. We may develop software and use hardware, but our first priority is thoughtware. Still, the cost of joining SIAM can seem high in a country with a developing economy. So we computed the lowest membership cost that SIAM could responsibly offer, and established the dues of $25 for our members in these countries.

The new members will receive the print version of SIAM News (10 issues a year) and the electronic version of SIAM Re-

view (which is published quarterly). All members will have full voting privileges. They will be invited to join any of SIAM's 11 Activity Groups (at the regular cost of $10 a year). They will have the same discounts for conferences as all other members. The simplest way to apply is to use the Web. For those who do not have access to the Web, an e-mail message to `service@siam.org` will bring instructions.

I am personally delighted with this decision by SIAM. Our subject is international, and this society is strongly international too. We will be able to reach active applied mathematicians everywhere with this new membership plan.

May I mention that our plan for nominating new members of SIAM is still in effect? The Web site makes it easy:

Just click on "Nominate Potential SIAM Members" and then use the form to suggest names. My experience is that people tend to do things when they are invited. SIAM journals and conferences often lead our members into new research directions. But joining the society comes first, and you can help.

Gilbert Strang
(gs@math.mit.edu)

2. Scope of SIAM Journal on Mathematical Analysis

The Officers of our Activity Group have submitted the following statement to Jim Crowley and Gil Strang (SIAM executive director and president, respectively). The executive Director intends to share this information with the new Editor-in-Chief of SIAM Journal on Mathematical Analysis.

STATEMENT BY THE OFFICERS OF SIAM SIAG-OPSF ON THE SCOPE OF SIMA

D. Lozier, Chair

W. Van Assche, Vice-Chair

C. Dunkl, Secretary

F. Marcellan, Program Director

The SIAM Journal on Mathematical Analysis (SIMA) was traditionally one of the better journals for publishing papers dealing with special functions. Until volume 19 (number 6, 1988), the scope of the journal was:

"Contains research articles on those parts of mathematical analysis that grow from and are applicable to engineering, the natural sciences, and numerical analysis. Topics include partial differential equations, functional analysis, bifurcation theory, dynamical systems, differential geometry, asymptotic analysis, harmonic analysis, integral transforms, and special functions."

In this list, the topics "asymptotic analysis, harmonic analysis, integral transforms, and special functions" indeed deal with aspects which are of interest to the SIAM Activity Group on Orthogonal Polynomials and Special Functions, which was founded in 1990.

It can be said that special functions are to mathematics the way mathematics is to the natural sciences; they are key tools. Consider important appearances in recent research areas: completely integrable quantum models, algebraic combinatorics, number theory, asymptotics, group representations, Fourier transforms, tomography, quantum groups, DeBranges proof of the Bieberbach conjecture, etc. In fact, the importance of special functions is demonstrated conclusively in the past 25 years of data from the Science Citation Index for Abramowitz & Stegun's Handbook of Mathematical Functions. Not only has the absolute number of citations of Abramowitz and Stegun been increasing steadily, its rate of growth exceeds the growth rate for the Index as a whole.

Unfortunately, starting from volume 20 (number 1, 1989), the scope of SIMA was changed and the topics mentioned earlier disappeared from the scope. Now the papers in the journal fall into two broad categories, the first being those that analyze interesting problems associated with realistic models for natural phenomena. The second category includes those papers which contribute in a substantial way to the general, analytical information and techniques which are likely to bear upon such models. Thus the journal no longer reflects as strongly as before the interest of our SIAG. Furthermore, no one on the present editorial board represents the research topics of interest to our SIAG. This was certainly different in the past, when F.W.J. Olver, R. Askey, G. Andrews and others were on the editorial board. Volume 25 (number 2, 1994) was an important special issue dedicated to Askey and Olver that contained several important papers which proved to be relevant to our SIAG. It is a pity that since then only few papers dealing with special functions were published in SIMA.

Our activity group strongly urges that the scope of the SIAM Journal on Mathematical Analysis again include such topics as special functions and rigorous asymptotics, and put more emphasis on mathematical analysis than on applied mathematics. After all, SIAM also publishes the SIAM Journal on Applied Mathematics for which the scope has a large intersection with the present scope of SIMA. The editorial board should have some members capable of judging papers on orthogonal polynomials and special functions. The SIAG is willing to advise in this matter.

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3. Authors Selected for NIST Digital Library Project

The National Institute of Standards and Technology (NIST) has selected authors for the following chapters of the Digital Library of Mathematical Functions (DLMF):

- Mathematical and Physical Constants. NIST.
- Algebraic and Analytical Methods. R. Askey & R. Roy.
- Asymptotic Approximations. F. Olver & R. Wong.
- Numerical Methods. C. Brezinski & W. Gautschi.
- Computer Algebra. P. Paule & F. Chyzak.
- Elementary Functions. S. Krantz.
- Gamma Function. R. Askey.
- Exponential Integral, Logarithmic Integral, Sine and Cosine Integrals. N. Temme.
- Error Functions, Dawson's Integral, Fresnel Integrals. N. Temme.
- Incomplete Gamma Functions and Generalized Exponential Integral. R. Paris.

- Airy and Related Functions. F. Olver.
- Bessel Functions. F. Olver & L. Maximon.
- Struve Functions and Anger-Weber Functions. R. Paris.
- Confluent Hypergeometric Functions. J. Wimp.
- Coulomb Wave Functions. M. Seaton.
- Parabolic Cylinder Functions. N. Temme.
- Legendre Functions and Spherical Harmonics. M. Dunster.
- Hypergeometric Functions. A. Olde Daalhuis.
- Generalized Hypergeometric Functions and Meijer G-Function. R. Askey.
- q-Hypergeometric Functions. G. Andrews.
- Classical Orthogonal Polynomials. R. Koekoek & R. Swarttouw.
- Other Orthogonal Polynomials. R. Koekoek & R. Swarttouw.
- Elliptic Integrals. B. Carlson.
- Jacobian Elliptic Functions and Theta Functions. P. Walker & W. Reinhardt.
- Weierstrass Elliptic Functions. P. Walker & W. Reinhardt.
- Bernoulli and Euler Numbers and Polynomials. K. Dilcher.
- Zeta and Related Functions. T. Apostol.
- Combinatorial Analysis. D. Bressoud.
- Functions of Number Theory. T. Apostol.
- Statistical Methods and Distributions. I. Olkin & D. Kemp.
- Mathieu Functions and Hill's Equation. G. Wolf.
- Lamé Functions. Spheroidal Wave Functions. H. Volkmer.
- Heun Functions. B. Sleeman & V. Kuznetsov.
- Painlevé Transcendents. P. Clarkson.
- Integrals with Coalescing Saddles. M. Berry & C.Howls.
- Wavelets. G. Strang.
- 3j, 6j, 9j Symbols. L. Maximon.

This list is subject to change, and all chapters are subject to editorial review and independent validation before acceptance by NIST. Contracts are in process now with some of the authors, and are impending for the others.

The work is being organized and supervised by 4 NIST editors and 10 associate editors from other institutions. The NIST editors and their areas of responsibility are: D. Lozier (General), F. Olver (Mathematics), C. Clark (Scientific Applications), and R. Boisvert (Information Technology). The associate editors and their areas of responsibility are: R. Askey (special functions), M. Berry (physics), W. Gautschi (numerical analysis), L. Maximon (physics), M. Newman (combinatorics and number theory), I. Olkin (statistics), P. Paule (computer algebra), W. Reinhardt (chemistry), N. Temme (special functions), and J. Wimp (special functions).

The DLMF is being modeled after the 1964 National Bureau of Standards Handbook of Mathematical Functions, M. Abramowitz and I. Stegun, editors. It is being prepared on the basis of a thorough review of the published archival literature, with emphasis on the presentation of those mathematical properties that are most useful in scientific and other applications. It will include computational information, pointers to software, illustrative applications, and graphics. It will be disseminated from a Web site at NIST with capabilities for browsing, searching, interactive visualization, and importation of information into documents or computer programs. Also, a book will be published with a CD-ROM that will reproduce many of the capabilities of the Web site. Funding has been provided by the National Science Foundation. Completion is due in 2003.

Further information can be found at the project Web site, `http://dlmf.nist.gov` .

See also `http://dlmf.nist.gov/about/publications` .

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4. Krawtchouk Polynomials Home Page

After a long pause I have updated the Krawtchouk Polynomials Home Page at: `http:/www.isir.minsk.by/~zelenkov/physmath/kr_polyn/` .

What is new?: 11 references added to the Bibliography.

Search facilities: Full text of the article (1929) in which Krawtchouk polynomials were introduced (in French original, English and Russian translations). If anybody could help to translate the text also into Ukrainian - it could be "in resonance" with Krawtchouk's ideas!

Important: if you cannot read the text of the article which have been converted from LaTeX to HTML by TTH please let me know what operating system you use.

Vadim Zelenkov
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5. New OPSF Webmaster and Website

The long awaited transfer of the OPSF web site from York University, Canada, to my institution is complete. Martin Muldoon, our capable webmaster for several years, has handed the reins to Bonita Saunders of NIST. Martin will, however, continue serving as OPSF-Net Editor (until the end of 2000).

I invite all of you to inspect the new site, as some changes have already been made, and send any comments to me. It is located at `http://math.nist.gov/opsf`

Daniel Lozier
(dlozier@nist.gov)

6. Welcome to Bonita Saunders

I am delighted to pass the task of OP-SF Webmaster to Bonita Saunders. Please change your links to `http://math.nist.gov/opsf` but I will keep the old link alive as long as necessary. It will contain the link to the new page

but will not be updated. Bonita is a mathematician in the Mathematical Software Group at NIST (National Institute of Standards and Technology) Gaithersburg, Maryland, USA. She holds the degrees of BA (William and Mary), MS (Virginia) and PhD (Old Dominion), all in Mathematics. She has worked in Boundary-fitted Grid Generation, Numerical Solution of PDEs and Visualization of Special Functions. Her e-mail address is: `bonita.saunders@nist.gov`

Martin Muldoon
(muldoon@yorku.ca)

7. New Indian Society for Special Functions and Their Applications

A new Indian Society for Special Functions and Their Applications has been formed with a web site maintained by Professor K. Srinivasa Rao (`ssfa@imsc.ernet.in`) at `http://www.imsc.ernet.in/~ssfa/` The Society has concluded an agreement with our Activity Group concerning mutual cooperation and exchange of Newsletter material.

Martin Muldoon
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8. Poster on special functions

Wolfram Research has informed us about a poster on special functions that they prepared. The poster is divided into five distinct panels: Elliptic functions, Elementary functions, Hypergeometric functions, Zeta and other functions, Special function (general). For details and pictures of these posters one can visit `http://www.specialfunctions.com`

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

About the Activity Group

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 have around 150 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 is:

`http://math.nist.gov/opsf/`

which currently covers the topics: Conference Calendar; Books, Conference Proceedings, etc.; Compendia, tools, etc.; Compiled booklist on OP-SF; Meeting Reports; Projects; Problems; Personal, Obituaries, etc.; History; Positions available; Miscellaneous; Memberlist; Preprint Servers and Links to WWW pages of interest to members. This is a convenient point of entry to all the services provided by the Group. Our Webmaster is Bonita Saunders (`bonita.saunders@nist.gov`).

The *Newsletter* is a publication of the Activity Group. It appears three times a year and is mailed by SIAM. Back issues are accessible at:

`http://www.imn.htwk-leipzig.de/~koepf/siam.html`

To receive the *Newsletter*, you must be a member of SIAM and of the Activity Group. SIAM has several categories of membership, including low-cost categories for students and residents of developing countries. For current information on SIAM and Activity Group membership, contact:

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WWW : `http://www.siam.org`
`http://www.siam.org/membership/outreachmem.htm`

The Activity Group also sponsors an electronic news net, called the OP-SF Net, which is transmitted periodically by SIAM. It is provided as a free public service; membership in SIAM is not required. The OP-SF Net Editor is Martin Muldoon (`muldoon@yorku.ca`). The Net provides fast turnaround compared to the *Newsletter*. To receive the Net, send your name and email address to `poly-request@siam.org`. To contribute a news item to the Net, send email to `poly@siam.org` with a copy to the OP-SF Net Editor. Please note that submissions to the Net are automatically considered for the *Newsletter*, and vice versa, unless the contributor requests otherwise. Back issues can be obtained by anonymous ftp from `ftp.wins.uva.nl` in the directory:

`pub/mathematics/reports/Analysis/koornwinder/opsfnet.dir`

or at the WWW addresses:

`http://turing.wins.uva.nl/ thk/opsfnet`

`http://www.math.ohio-state.edu/JAT`

`http://math.nist.gov/opsfnet/archive`

Finally, the Activity Group operates an email discussion group, called OP-SF Talk. To subscribe, send the email message

subscribe opsftalk Your Name

to `listproc@nist.gov` . To contribute an item to the discussion, send email to `opsftalk@nist.gov` . The archive of all messages is accessible at:

`http://math.nist.gov/opsftalk/archive`

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 LaTeX format. Other formats are also acceptable and can be submitted by e-mail, regular mail or fax.

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