Orthogonal Polynomials and Special Functions

SIAM Activity Group on Orthogonal Polynomials and Special Functions

★ ★ ★ ★ **Newsletter** ★ ★ ★ ★

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Contents

From the Editor

In the most recent issue, I announced that I will quit my editorship and I asked for possible successors. I am pleased to announce that Renato Álvarez-Nodarse, Universidad Carlos III de Madrid, jointly with Rafael J. Yáñez, Universidad de Granada, have agreed to succeed me as editors. Both will already co-edit the next two issues with me. So you are encouraged to send your material either to me or to one of them. You will find their e-mail addresses on p. 23.

Below Charles Dunkl gives a *Message from the Chair* on this topic, and Renato and Rafael introduce themselves on p. 2.

Again, much material was collected from OP-SF Net. Let me say thank you to everybody who provided input for the current issue. I am particularly thankful for the many reports on previous meetings.

As usual I hope you enjoy reading this issue!

January 31, 1998 Wolfram Koepf

Message from the Chair

Greetings and my wishes for a happy and prosperous 1998 to all. I am pleased to announce the appointment of Professors Renato Álvarez-Nodarse and Rafael Yáñez as co-editors of this Newsletter. There will be a transition period as Wolfram Koepf has kindly agreed to produce at

least one more issue and at the same time help the new editors get started. Renato and Rafael are at the University Carlos III in Madrid and the University of Granada, respectively. They are writing a short note in this issue by way of introduction. The terms of the current officers end December 31, 1998 and a nominating committee will be appointed by the SIAM President to prepare a slate for the election. It is not too early to start thinking about nominations; please feel free to send possible candidates' names to any of the present officers. The minisymposium at the SIAM annual meeting of 1997 dealing with special function handbooks, which was organized by us, has stirred up lots of interest. It is expected that there soon will be an article in the SIAM News about the various projects. Recall the URL for the NIST project working on a successor to the Abramowitz and Stegun volume is http://math.nist.gov/DigitalMathLib/.

On behalf of the Activity Group, I express our appreciation to Wolfram Koepf for his service to the Group and the world-wide community of special function workers, in his work as Editor, the organization of the ISAAC session in June 1997, and his ongoing project to develop computer algebra techniques for OP&SF. We wish him much success in his new appointment in Leipzig.

It seems to me that our field continues to prosper and to maintain a high level of activity and vitality. There is exciting work in asymptotics, applications to physics, harmonic analysis and quantum groups, not to mention the traditional area of combinatorics. I look forward to working with our Group to help the research and applications community move forward in the discovery and dissemination of mathematical knowledge.

Charles F. Dunkl
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Introduction of Forthcoming Editors

I received my Master of Science Degree in mathematical physics (advisor: Dr. Yuri F. Smirnov) in 1992 at the Physics Department of the Moscow State University. I have finished my PhD Thesis in Mathematics (advisors: Dr. F. Marcellán and Dr. A. G. García) in 1996 at the *Departamento de Matemáticas* of the *Universidad Carlos III de Madrid*. At the present moment I am Assistant Professor in the Departamento de Matemáticas of the Universidad Carlos III de Madrid, currently teaching Linear Algebra and Calculus for the first year students at the Engineering School (*Escuela Politécnica Superior*). I am also an associate researcher (investigador asociado) of the Instituto "Carlos I" de Física Teórica y Computacional of the *Universidad de Granada*. The main topics which I am interested in are Orthogonal Polynomials and Special Functions, their applications in several areas of Mathematical Physics (Quantum Physics, representation theory of q-algebras and groups, the q-Schrödinger equations, q-oscillators, etc.), Group Theory, Quantum Groups, etc; the connection and linearization problems involving hypergeometric polynomials (not necessarily orthogonal), among others. Also I am interested in the application and implementation of programs by using symbolic computer algebra systems such as Mathematica, Maple, etc, to the above topics.

Renato Álvarez-Nodarse
(nodar@math.uc3m.es)

I received a BSc. in Theoretical Physics in 1991, and a PhD. in Physics in 1996, under the supervision of Prof. J.S. Dehesa, with a thesis entitled *Information Entropy, Orthogonal Polynomials and Multielectronic Systems*. Since 1995 I am Assistant Professor in the *Department of Applied Mathematics* of the *University of Granada*, where I teach, among other subjects, Numerical Analysis. My research interests are centered in Orthogonal Polynomials and Special Functions, mainly in algebraic and spectral properties, entropic integrals and numerical and computer algebra problems. Also, I apply these mathematical objects to a variety of quantum-mechanical properties of electronic systems, specially those described by macroscopic quantities which are accessible via density-functional, complex-analytic and information-theoretic techniques.

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Memorial Note about Vasily Borisovich Uvarov (1929 - 1997)

The distinguished Russian mathematician and physicist Vasily Borisovich Uvarov died on 23rd of September 1997, four days after his 68th birthday. A flamboyant personality of splendid health, he suddenly contracted Alzheimer's disease about 5 years ago, but died in hospital from pneumonia.

Born into an old and cultivated Muscovite family, he graduated *cum laude* in 1952 from the Physics Department of *Moscow State University*. For the rest of his life, he worked at the M.V. Keldysh Institute of Applied Mathematics. During his last years he was head researcher at the Institute and professor at MSU.

When starting his work at the Institute, Uvarov entered the Ippolitov-Ivanov Moscow Musical School as a student of violin and soon graduated from the School. He played the violin throughout his life. As a joke he used to say that, playing the violin, he could compete with Einstein.

Research in the domain of high-temperature plasma physics (to be more exact, in domain of quantum statistical models and interaction of radiation with matter), started in the late 1950s. At that time computers were only at the very beginning of their development, so the researcher had to know how to obtain analytical solutions of rather complicated sets of differential equations and, more specifically, had to be proficient in the art of dealing with many special functions. Full control both of analytical and difference methods enabled Uvarov to solve the problem of photon absorption in spectral lines of many-electron atoms. In 1962 V.B. Uvarov received the country's highest scientific award - the Lenin prize.

Later, Uvarov and Nikiforov developed a new approach to the theory of special functions using a generalization of the Rodrigues formula. They succeeded in obtaining, in the form of a Cauchy integral, a unified integral representation for functions of hypergeometric type (1974). The later book *Special Functions of Mathematical Physics* was based on these ideas and went through several editions in Russian, French and English. The latest edition was translated into English by the famous American mathematician Ralph Boas (1988).

In 1983 it came to be recognized that along with the differential equation of hypergeometric type one has to introduce the *difference equation of hypergeometric type* over nonuniform lattices for many functions, given on discrete sets of argument values. The polynomial solutions of this equation (so-called q-polynomials) were obtained, investigated and classified in collaboration with A.F. Nikiforov and S.K. Suslov in the book *Classical Orthogonal Polynomials of a Discrete Variable* (Moscow, Nauka, 1985; Springer-Verlag, 1991). This plan has been carried out independently by the American mathematicians R. Askey and J.A. Wilson.

Many-sidedly talented and wonderfully modest, sometimes unyielding, - this is how Vasily Borisovich Uvarov will stay in our memory.

Arnold Nikiforov
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Reports from Meetings and Conferences

1. VIII Simposium Sobre Polinomios Ortogonales y Aplicaciones, Sevilla, September 22-26, 1997

The *VIII Simposium sobre Polinomios Ortogonales y sus Aplicaciones* was held in Sevilla during 22-26 September 1997. It is the eighth in a line of symposia on orthogonal polynomials and their applications which are held in Spain once a year. But it fits also into a series of major European conferences on orthogonal polynomials (Bar-le-Duc, Segovia, Erice, Delft, Sevilla). In particular, conferences of this last series try to offer a state of the art, although no conference nowadays will cover the whole area of orthogonal polynomials and special functions. Therefore it seemed appropriate to ask a few people to report on the Sevilla conference. Bill Connett and Alan Schwartz describe the general setting. Next Arno Kuijlaars on the one hand and Margit Roesler and Michael Voit on the other hand discuss, each from their own specialism and taste, the scientific trends which became apparent from the lectures in Sevilla.

Tom H. Koornwinder
(thk@wins.uva.nl)

This international conference had approximately 150 registrants, it featured ten plenary talks and approximately 70 talks in the research seminars. It also included the most memorable opening session in recent memory. This session took place in the main university building which was formerly the tobacco factory made famous in the opera Carmen. The Chairman of the Organizing Committee, Professor Durán, entertained us with a list of the organizations that had promised support for this conference, and expressed his gratitude for that support, carefully titrated to reflect the degree to which the organizations had fulfilled their promises. This candor was very much appreciated by those members of the audience that had struggled with similar problems in the past. The Vice-Rector of the University then gave an elegant and emotional speech comparing the researchers' pursuit of mathematics to Don Pedro's pursuit of Carmen, with a number of interesting asides about the complexity and volatility of our beloved mathematics, and the dangers inherent in the pursuit of such a coy and demanding muse. In any event, the audience was afire with passion, and greeted the first plenary speaker, Herbert Stahl, as the young matador leading the corrida. We were not disappointed, Professor Stahl gave an elegant and enlightening performance. This was a very full meeting with sessions from 9:30 in the morning until 6:00 or 7:00 in the evening, but the organizers fitted in three very pleasant events. The participants were treated to an evening tour of the Cathedral (third largest in Europe), the Giralda tower (the bell tower, formerly a mosque), Los Reales Alcazares (the Mudjehar Royal Palace) and the Bario de Santa Cruz (former Jewish quarter), so we had ample opportunity to contemplate Spain's Muslim, Jewish and Christian Heritage. The conference dinner, a sumptuous affair, took place in the Gardens of Villa Luisa. An evening of Flamenco was provided for Friday night. Of course, many extracurricular excursions were mounted to sample the delights of this wonderful city. The program of plenary talks:

Daniel Alpay, "Exact formulas for continuous and discrete orthogonal polynomials with rational weights and applications to solutions of inverse spectral problems"

Alexandre Aptekarev, "Asymptotics of general multiple orthogonal polynomials"

Richard Askey, "Combinatorics of the classical orthogonal polynomials"

T. H. Koornwinder, "A survey of symbolic computation for orthogonal polynomials and special functions"

A. L. Levin and D. S. Lubinsky (speaker), "Orthogonal polynomials for exponential weights"

A. Martinez, "Asymptotic properties of Sobolev orthogonal polynomials"

E. A. Rakhmanov, "Constrained equilibrium measure and zero distribution of discrete orthogonal polynomials"

E. B. Saff, "Zeros of orthogonal polynomials"

Herbert Stahl, "Spurious poles of Padé approximants"

Vilmos Totik, "Orthogonal polynomials with respect to varying weights and the so called universality law"

Special mention must be made of Professor Lubinsky's presentation, which set a new and very high standard for multimedia presentations. Every theorem by a famous person was accompanied with an historic photograph or drawing, and the mathematics wizard managed to place an interesting and appropriate cartoon on every slide, frequently drawing attention to some of the more surprising moments in the line of argument. This sets the new standard in presentation which Doron Zeilberger can now aim for.

All the participants were grateful for the efforts made by the organizing committee A.J. Durán, P. López-Rodríguez, and J.C. Medem of the University of Sevilla. The gratitude extended beyond their efforts in organizing the meeting, providing comfortable accommodations, and arranging the cultural events. We are all grateful for the opportunity to visit this beautiful old city.

William C. Connett and Alan L. Schwartz
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New Trends in Orthogonal Polynomials from the Sevilla Conference

The impression from the Sevilla meeting is that the field of orthogonal polynomials is still very much alive. A number of new directions have appeared where new results were obtained and more developments are to be expected. Of course, my impression is biased by my own interests, which are in asymptotics. This area was very well represented in Sevilla and in the plenary talks in particular. E.A. Rakhamnov reported on his very elegant results on asymptotics for polynomials satisfying a discrete orthogonality. This work has already attracted a number of follow-up papers, and the interest is continuing to grow, especially in the direction of strong asymptotics. Another direction that has grown in importance over the last few years, is the theory of matrix orthogonal polynomials, as witnessed by the plenary talks of D. Alpay and E.B. Saff. There is continuing interest in the theory of Sobolev orthogonal polynomials, with main contributions from the large and active Spanish school. A review on asymptotic results was presented by A. Martinez. It is clear that progress has been made in recent years. Multiple orthogonality has been a favourite with the Russian school. It deserves wider interest, because of its connections with simultaneous Padé approximation and irrationality proofs in number theory. The topic was reviewed by A. Aptekarev. Of basic importance remain the applications of orthogonal polynomials in

mathematical physics. Relations with integrable systems and random matrices were discussed in a number of talks (e.g. Chen, Grunbaum, Kaliaguine, Totik). One of the highlights of the Sevilla meeting was V. Totik's announcement of a proof of the universality conjecture in random matrices using clever estimates on orthogonal polynomials. This kind of interaction with other areas keeps our field alive.

Arno Kuijlaars
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Impressions from the Sevilla Conference

This symposium has its roots in a series of Spanish meetings during the 1980's. Since then, it has become a constantly growing international meeting ground for scientists working on special functions and their applications. The present meeting was attended by about 150 participants from all over the world.

There were 10 one-hour plenary talks (see the list in the report of Bill Connett and Alan Schwartz), and about 70 research talks which were held in four parallel sessions. In fact, the program was quite dense, and it was often difficult for us to decide which session to attend. Nevertheless, we had the impression that the arrangement of the sessions was carefully planned; as far as possible, the afternoon sessions were dedicated to particular topics. Here the variety was very broad: there were sessions on more classical aspects of orthogonal polynomials including asymptotics, zeros, and moment problems, as well as Sobolev orthogonal polynomials, q-special functions, and multivariable aspects. Several sections were devoted to applications in approximation theory, differential equations, mathematical physics, and probability theory. Finally, a special computer algebra session was organized by SCAGOP (*Spanish Computer Algebra Group on Orthogonal Polynomials*).

Compared to earlier conferences of this kind (like Delft or Granada), we here in particular enjoyed a growing emphasis on multivariable structures and a strong impact from problems in mathematical physics and probability theory. As usual at conferences of this size, the scientific level of the talks was varied. Among the plenary lectures, we were in particular impressed by the opening lecture of Herbert Stahl and the excellent performance of Doron Lubinsky.

The organization of the symposium was almost perfect—except for the queues at the computer facilities. Most participants were conveniently accommodated at the Residence Hernando Colon. Besides the intense scientific part of the conference, an extraordinary program of social activities was offered; here we especially remember the conference dinner in the Gardens of *Villa Luisa* and the (almost?) authentic Flamenco show on Friday night. The organizing committee, consisting of A.J. Durán, P. López-Rodríguez, and J.C. Medem, has really done a great job!

Margit Roesler and Michael Voit
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2. International Workshop: RIMS, Kyoto, October 20-31, 1997

At RIMS (*Research Institute of Mathematical Science*, Kyoto, Japan) an international workshop on *Invariant Differential Operators, Special Functions and Representation Theory* was held during October 20-31, 1997. The organizer was Toshio Oshima (University of Tokyo). I take the following information from the URL http://w3rep.math.h.kyoto-u.ac.jp/projecte.html#meeting. Below Mathijs Dijkhuizen, who participated, will give a report.

One half of the workshop (the second week) was devoted to *Integrable systems of difference and differential equations*. The main speakers, with series of 3 or 4 lectures each, were

Eric M. Opdam (Leiden Univ.): Dunkl Operators

> *Abstract:* In these lectures I will give an overview of results on Dunkl's *differential-reflection* operators, up to the most recent developments. Mainly I will concentrate on the (differential) trigonometric case, the case of the Dunkl-Cherednik operators, because in this case the theory has reached the most mature level at present. And also there are several older theorems and applications whose proofs can be polished by modern methods, but many of these things were never written. So I feel that giving such a series of lectures can be rewarding, and I am happy to embark on such a project. Roughly, I have in mind to treat the following subjects:
>
> **1. Definition and basic analytic results.** The Knizhnik-Zamolodchikov connection, the Harish-Chandra system, monodromy representation, the shifting principle, asymptotic expansions, the Gauss' summation formula.
>
> **2. Algebraic Properties.** Nonsymmetric orthogonal polynomials, the graded Hecke algebra, (affine) intertwiners, the recursion formula of Knop and Sahi.
>
> **3. Harmonic Analysis.** The Fourier transform for the Dunkl-Cherednik operators, the Paley Wiener theorem, the action of the affine Weyl group.
>
> **4. Residue calculus for root systems.** The Plancherel measure for the attractive case; classification of all square integrable eigenfunctions, and their explicit norms.

S. Ruijsenaars (CWI, Amsterdam): Special Functions Solving Analytic Difference Equations

Abstract:

I. Generalized gamma functions.
II. A generalized hypergeometric function.
III. Generalized Lamé functions.

I. We discuss a new solution method for difference equations of the form $F(z+ia/2)/F(z-ia/2) = \Phi(z)$, with $\Phi(z)$ meromorphic and free of zeros and poles in a strip $|\Im(z)| < C$. The method gives rise to generalized gamma functions of hyperbolic, elliptic and trigonometric type (Euler's gamma function being of rational type), whose properties we sketch.

II. The hyperbolic gamma function can be used as a building block to construct a novel generalization of the hypergeometric function ${}_2F_1$. The new function is a simultaneous eigenfunction of four independent hyperbolic difference operators of Askey-Wilson type. The integral representation through which this joint eigenfunction is defined generalizes the Barnes representation for ${}_2F_1$. It is meromorphic and has various remarkable symmetry properties that are not preserved for its $q \to 1$ (or 'nonrelativistic') limit ${}_2F_1$.

III. The $q = 1$ (nonrelativistic) Lamé differential operator can be generalized to a $q \neq 1$ (relativistic) difference operator. (The latter may be viewed as the Hamiltonian defining the elliptic relativistic Calogero-Moser N-particle system for $N = 2$.) We present eigenfunctions of this operator. They are in fact joint eigenfunctions of three independent difference operators. The functions are used to define the Hamiltonian as a self-adjoint operator on a Hilbert space. Their asymptotics is governed by a c-function that is a quotient of two elliptic gamma functions.

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Some Impressions from the Workshop at RIMS

The international workshop at RIMS late October was part of the scientific activities organized in the framework of a special Research Project on Representation Theory. Most of the activities are concentrated in the autumn. The project includes the invitation of a number of foreign researchers to RIMS for a more or less extended period. The two distinguished visitors this autumn are Prof. Grigori Olshanski (Moscow) and Prof. Eric Opdam (Leiden), who are staying here for four months.

The workshop was split into two parts. The first week was devoted to representation theory and featured two series of lectures by Olshanski (on combinatorial and probabilistic aspects of harmonic analysis on big, i.e. infinite-dimensional, groups) and Prof. Michael Eastwood (Adelaide, on invariant differential operators on homogeneous spaces) plus a number of other talks. During the second week the topic was integrable systems of difference and differential equations. Since I did not attend the first part of the workshop, I will restrict myself to some comments about the second part. As suggested by the topic, most of the talks were somehow concerned with systems of commuting operators. The two main speakers were Eric Opdam and Prof. Simon Ruijsenaars (Amsterdam), who each gave three or four one-hour talks.

Opdam talked about trigonometric Dunkl operators and their use in the study of multivariable hypergeometric functions associated with root systems. Hypergeometric functions in one variable have been known for a very long time; the earliest indications how to generalize them to many variables came from representation theory, where they arise as zonal spherical functions on Riemannian symmetric spaces. The notion of Dunkl operator, however, is something completely new which is not all hinted at by the connection with Riemannian symmetric spaces. Dunkl wrote down his original differential-reflection operators with rational coefficients around 1989. One of their main properties is that they commute with each other. A trigonometric version of these operators was introduced by Cherednik who related them to the degenerate affine Hecke algebra. The importance of Dunkl operators for the theory of hypergeometric functions is explained by the fact that they allow one to give an elementary algebraic construction of the commuting system of hypergeometric differential operators for arbitrary values of the coupling constants. The existence of this hypergeometric system was established earlier by Heckman and Opdam using analytic methods. Over the last couple of years a whole body of theory has developed around Dunkl operators.

Opdam's talk was phrased in the elegant language of arbitrary reduced root systems and Weyl groups. This was in quite some contrast with Ruijsenaars' series of lectures, which, though certainly no less interesting, was characterized by a rather down-to-earth approach to a one-variable problem, namely the study of meromorphic solutions of certain types of analytic difference equations. Ruijsenaars actually started by remarking that an analyst from the late nineteenth century would have had no problem following at least the first part of his talks. Analytic difference operators were studied by several distinguished mathematicians until less than a hundred years ago, but later they failed to attract much interest. This seems to be changing now. Due to a notable lack of general theory about solutions of analytic difference equations most results have to be proved "by hand". One striking feature is the (rather obvious) fact that the solution space is usu-

ally infinite-dimensional. By imposing certain conditions on the asymptotic behaviour of the solution one can, however, arrive at certain uniqueness results. Ruijsenaars' motivation for studying these analytic difference equations partly comes from relativistic analogues of the quantum integrable Calogero-Moser-Sutherland models for N interacting particles on the real line. The trigonometric versions of these relativistic quantum models may be regarded as a q-analogue of the hypergeometric system discussed by Opdam. As shown by Cherednik, their algebraic properties are also amenable to a Dunkl operator approach. The polynomial solutions of these systems have been studied by Macdonald and others (for reduced root systems) and Koornwinder, Van Diejen, Noumi and others in the BC_n case (in the one-variable case they reduce to well-known families of q-hypergeometric polynomials of Askey-Wilson type). These polynomials are also known to occur in connection with quantum groups. As for non-polynomial solutions of these systems, not much is known at this time. As is apparent from Ruijsenaars' talks, a lot of interesting work in this direction is still waiting to be done.

In short, this was a very stimulating workshop with some very interesting mathematics.

Mathijs S. Dijkhuizen
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Forthcoming Meetings and Conferences

1. Applications and Computation of Orthogonal Polynomials, Oberwolfach, Germany, March 22-28, 1998

A meeting on *Applications and Computation of Orthogonal Polynomials* will be held at Mathematisches Forschungsinstitut Oberwolfach, Germany from March 22 to March 28, 1998.

The organizers are

Walter Gautschi, West Lafayette
Gene H. Golub, Stanford
Gerhard Opfer, Hamburg

Participants of the meetings at Oberwolfach are invited personally by the director of the institute. The participation is subject to such an invitation. The e-mail address for the administration at Oberwolfach is admin@mfo.de.

Interested researchers, in particular young mathematicians, can contact the administration of the institute. Since the number of participants is restricted, not all inquiries can be considered.

This announcement is based on Oberwolfach's URL http://www.mfo.de/.

2. VIIth International Scientific Krawtchouk Conference: Kiev, Ukraine, May 14-16, 1998

The VIIth International Scientific Krawtchouk Conference will be held on May 14-16, 1998 at the *National Technical University of Ukraine* (KPI, Kiev).

Sections:

- Differential and Integral Equations, their Application
- Algebra, Geometry. Mathematical and Numerical Analysis
- Probability Theory and Mathematical Statistics
- History and Technique of Mathematical Teaching

Send abstracts (2-3 pages with 1.5 spacing; not folded; report title; below - surname, name, city, university or organisation) to

Mrs Anna Yuzhakova
Tsytadelnaya St. 5/9, acmd. 26 Kiev - 15, 252015
The Ukraine

Deadline: March 1, 1998

Registration Fee: 15 grvn (7 US$)

See details on the Krawtchouk Polynomials Home Page (http://www.isir.minsk.by/zelenkov/physmath/kr_polyn).

Vadim Zelenkov
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3. Symmetries and Integrability of Difference Equations: Sabaudia, Italy, May 16-22, 1998

This series of international meetings started in 1994: the first *Symmetries and Integrability of Difference Equations* (SIDE) meeting was held in Esterel, Quebec (near Montreal - Canada) and was organized under the auspices of the CRM (Centre de Recherches Mathématiques) of the Université de Montreal. A second meeting took place in 1996 at the University of Kent in Canterbury (UK). Informations on the 1st SIDE meeting has been reported in: *Symmetries and Integrability of Difference Equations*, edited by D. Levi, L. Vinet and P. Winternitz, AMS 1996.

The meeting is intended to bring together specialists from various disciplines, all working or using methods from discrete integrable systems, i.e. systems that can be described by ordinary or partial difference equations and that allow for exact methods for their solutions. This domain forms the core of a great variety of fields, including classical and quantum physics, computer science, mathematical biology, economics, numerical analysis, difference geometry, and so on.

The SIDE meetings want to be a point of contact between researchers of various disciplines on discrete systems who otherwise would not be able to interact among themselves. The participation of young scientists is encouraged.

The main topics of the present meeting will be: integrable difference equations, symmetries of ordinary and partial difference equations and reduction techniques, integrable correspondences, asymptotics and difference monodromy problems, orthogonal polynomials and q-special functions, discrete geometry, applications to computer science, neural networks, physical, biological, and economical systems.

As in the previous meetings of the series, to enhance the interactions and to promote informal contacts, all the participants will be accommodated under the same roof, that in this case will be the Hotel "Oasi di Kufra", as the venue where the lectures are delivered and where the social activities are organized (meals, receptions, etc.). So as not to overload the meeting with talks, while keeping the single-session format, we plan to accept a limited number of participants (< 50). The format of the meeting consists of a certain number of short lectures (30 minutes) and of a few longer review expositions intended for students and young researchers. A poster session will be available for presenting partial or side results.

The cost of participation will consist of a registration fee of Lit. 150000 (equivalent to $\approx$ 90 US$) if paid before March 15th, 1998, otherwise Lit. 180000 ($\approx$ 110 US$) and of a flat all-inclusive rate of Lit. 810000 ($\approx$ 480 US$) (+ Lit. 180000 for single occupancy rooms). This flat rate might be partly or completely waived for qualified participants who have no funds to support their participation if our applications for financial support will be successful. The listed prices are subject to small variations according to fluctuations of the exchange rates.

Interested persons should contact the local organizers, preferably by e-mail. Please take into account that there will be room for, at most, 20 talks (30 minutes). Consequently the scientific committee will decide whether the applicant's contribution can be accepted as a talk or as a poster.

For a list of speakers see the October Newsletter 8-1 on p. 7.

The local organizers are:

D. Levi, O. Ragnisco
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The International Scientific Committee is: F.W. Nijhoff (U. Leeds - UK) chairman, A. Bobenko (TU Berlin - Germany), J. Hietarinta (U. Turku - Finland), N. Joshi (U. Adelaide - Australia), M. Kruskal (Rutgers U. - USA), D. Levi (U. Roma 3 - Italy), V. Papageourgiou (U. Patras - Greece), C. Viallet (U. Paris VI - France), P. Winternitz (U. Montreal - Canada).

D. Levi
(levi@amaldi.fis.uniroma3.it)

4. Continued Fractions: University of Missouri, Columbia, May 20-23, 1998

On May 20-23, 1998, the meeting *Continued Fractions: From Analytic Number Theory to Constructive Approximation Information* takes place at the University of Missouri, Columbia, Missouri.

Plenary Speakers: R. A. Askey, B. C. Berndt, D. C. Bowman, A. Bultheel, H. H. Chan, M. H. Ismail, W. B. Jones, L. J. Lange, L. Lorentzen, D. R. Masson, P. Nevai, O. Njastad, W. van Assche.

Program: In addition to the plenary talks, the conference program will include sessions for 25-minute contributed talks.

Abstracts: Abstracts of talks (TEX files by e-mail or hard copies) should be sent by May 8, 1998, to one of the addresses below.

Registration: There will be a conference fee of $ 25 payable on arrival (graduate students exempt). Registration forms can be obtained upon request by e-mail or from our conference Web site.

Organizing Committee: M. Ashbaugh, B. Berndt, F. Gesztesy, N. Kalton, J. Lange, and I. Verbitsky.

Information: cf@math.missouri.edu or by regular mail to F. Gesztesy, Dept. of Mathematics, Univ. of Missouri, Columbia, MO 65211. Conference home page: http://www.math.missouri.edu/~cf/. We have applied for funds to defray travel and lodging costs. Preference will be given to graduate students and recent PhDs. Those interested in applying for such funds please contact F. Gesztesy by April 30, 1998.

This announcement is based on the URL http://www.ams.org/mathcal/info/1998_may20-23_columbia.html.

5. Formal Power Series and Algebraic Combinatorics: Toronto, June 15-19, 1998

The 10-th international Conference on *Formal Power Series and Algebraic Combinatorics* will take place from June 15-19, 1998 at the *Fields Institute*, Toronto.

Topics: Algebraic and bijective combinatorics and their relations with other parts of mathematics, computer science and physics.

Conference Program: Invited lectures, contributed presentations, poster session, software demonstrations.

Invited Speakers: G. Benkart (USA), P. Cameron (Eng-

land) (not confirmed), P. Dehornoy (France), B. Derrida (France), P. Diaconis (USA), C. Godsil (Canada), K. Ono (USA), J. Y. Thibon (France), B. Sturmfels (USA).

Official languages: English and French.

Program Committee: I. Goulden, Chairman (Canada), N. Bergeron (Canada), S. Billey (USA), F. Brenti (Italy), R. Cori (France), S. Dulucq (France) K. Eriksson (Sweden), O. Foda (Australia), S. Fomin (USA/Russia), I. Gessel (USA), C. Greene (USA), A. Hamel (New Zealand), D. Kim (Korea), C. Krattenthaler (Austria), D. Krob (France), M. Noy (Spain), V. Reiner (USA), C. Reutenauer (UQAM), F. Sottile (U. Toronto), T. Visentin (U. Winnipeg), M. Wachs (USA), H. Yamada (Japan), G. Ziegler (Germany).

For more information on registration and support, consult the WWW site http://www.math.yorku.ca/bergeron/FPSAC98.html or e-mail bergeron@mathstat.yorku.ca.

Organizing Committee: N. Bergeron, Chairman (York U.), M. Delest (U. de Bordeaux), F. Sottile (U. Toronto), W. Whiteley (York U.).

Nantel Bergeron
(bergeron@mathstat.yorku.ca)

6. q-Series, Combinatorics and Computer Algebra: South Hadley, June 21-25, 1998.

As one of the *Joint Summer Research Conferences in the Mathematical Sciences*, a Conference on *q-Series, Combinatorics and Computer Algebra* will be held at Mount Holyoke College, South Hadley, Massachusetts, USA, June 21–25, 1998. The co-chairs are Mourad Ismail (ismail@math.usf.edu) and Dennis Stanton (stanton@math.umn.edu).

The topics to be covered will include:

1. classical q-series, number theory and orthogonal polynomials,
2. multivariable polynomials and quantum groups,
3. applications of computer algebra packages to combinatorial problems,
4. applications of q-series to physical problems.

Preliminary list of speakers: George Andrews, Richard Askey, Pavel Etinghof, Dominique Foata, George Gasper, Ira Gessel, R. William Gosper, Christian Krattenthaler, Tom Koornwinder, Steve Milne, Ken Ono, Doron Zeilberger.

Those interested in attending and in possible financial support should contact the Summer Research Conference Coordinator, American Mathematical Society (rgc@ams.org).

The above information is summarized from the print version of the Notices of the American Mathematical Society, November 1997, pp. 1412-1414. However, the list of topics and speakers for this conference is mistakenly transposed to the announcement of the conference on *Geometric Group Theory and Computer Science* (July 5-9).

Martin Muldoon
(muldoon@yorku.ca)

7. International Workshop on Orthogonal Polynomials: Numerical and Symbolic Algorithms, Madrid, June 29-July 2, 1998

The main **aim** of the next (1998) Workshop is that a relatively small number of invited mathematicians discuss and review recent progress in the Theory of *Orthogonal Polynomials* with special emphasis on numerical applications and symbolic algorithms. The Workshop will take place in the main building of the *Escuela Politécnica Superior*, *Universidad Carlos III de Madrid*, Leganés (Madrid).

The topics to be considered will be:

1. Quadrature formulas
2. Spectral methods in boundary value problems
3. Numerical Linear Algebra
4. Symbolic algorithms and software
5. Combinatorics

It will be possible for interested participants to present their own contributions in the above mentioned areas. Because the limited number of short communications we ask participants who want to present their works to send us, as soon as possible (March 31, 1998), the abstract (no more than one page). Priority will be given to those talks closely related to the main subject of the Workshop.

The invited speakers are:

- Walter Gautschi (Purdue University, USA), *Orthogonal Polynomials and Quadrature* and *Rational Gauss-type Quadrature Rules*
- Gene Golub (Stanford University, USA), *Matrices, Moments and Quadrature* and *Solution of Regularized Systems*
- Wolfram Koepf (Hochschule für Technik, Wirtschaft und Kultur Leipzig, Germany), *Software for the Algorithmic Work with Orthogonal Polynomials and Special Functions, I* and *II*
- Yvon Maday (Université Pierre et Marie Curie, France), *The Basic Spectral Element and Mortar Elements Methods for Elliptic Problems* and *The Spectral Element Methods for Resolution of the Stokes and Navier-Stokes Problems*
- Marko Petkovšek (University of Ljubljana, Slovenia), *Linear Operators and Compatible Polynomial Bases*, *I* and *II*
- Doron Zeilberger (Temple University, USA), *The Unreasonable Power of Orthogonal Polynomials in Combinatorics, I* and *II*

Organizing Committee:

- M. Alfaro (Univ. de Zaragoza),
- R. Álvarez-Nodarse (Secretary) (Univ. Carlos III),
- J. Arvesú (Univ. Carlos III),
- F. Marcellán (Chairman) (Univ. Carlos III).

To get more information please contact:

R. Álvarez-Nodarse
F. Marcellán
Departamento de Matemáticas
Escuela Politécnica Superior
Universidad Carlos III de Madrid
Butarque 15, 28911, Leganés, Madrid
fax: +34-1 624-94-30
phone: +34-1 624-94-70, +34-1 624-94-42
e-mail: iwop98@dulcinea.uc3m.es

For updated information visit the IWOP'98 WWW page http://dulcinea.uc3m.es/users/workshop/iwop98.html. On http://dulcinea.uc3m.es/users/workshop/iwop96.html you will find information about the most recent Workshop on *Orthogonal Polynomials* held in Leganés on June 24-26, 1996.

Renato Álvarez-Nodarse
(nodar@math.uc3m.es)

8. 4th International Conference on Lattice Paths Combinatorics and Applications: Vienna, Austria, July 8-10, 1998

This conference is dedicated to the memory of T.V. Narayana. Topics to be covered by the conference include

- lattice paths and boundaries
- plane partitions
- Young tableaux
- q-calculus
- orthogonal polynomials
- random walk problems
- nonparametric statistical inference
- discrete distributions and urn models
- queueing theory
- analysis of algorithms

Submission of papers: Authors are invited to submit abstracts of at most four pages before February 1, 1998. Preferred way of submission is by sending **one** postscript file by e-mail to boehm@isis.wu-wien.ac.at.

If an author is not able to send a postscript version of her/his extended abstract, four copies of the extended abstract should be mailed to Walter Böhm, address below. Authors are also requested to indicate how much time they will need to present their talks.

The complete versions of the papers to be presented should be received not later than July 10, 1998. After a standard refereeing process papers accepted by the scientific committee will be published in a special issue of the *Journal of Statistical Planning and Inference*.

Location: The conference will take place at the *Institut für Mathematik* of the *Universität Wien*. The first talk is scheduled on July 8, 1998 at 9:00 a.m.

Organizing committee: W. Böhm, University of Economics, Vienna, Austria; Ch. Krattenthaler, University of Vienna, Austria; S.G. Mohanty, McMaster University, Canada; K. Sen, University of Delhi, India.

Scientific committee: N. Balakrishnan, McMaster University, Canada; Ch. Charalambides, University of Athens, Greece; E. Csaki, Hungarian Academy of Science, Hungary; I. Gessel, Brandeis University, U.S.A.; A.W. Kemp, University of St. Andrews, Scotland; C.D. Kemp, University of St. Andrews, Scotland; S.G. Mohanty, McMaster University, Canada; H. Niederhausen, Atlantic University, U.S.A.

Further information: A WWW site http://www.wu-wien.ac.at/wwwu/institute/stat1/lp/lp.html has been set up for the conference which will always contain the latest state of affairs. For any further question, please just write to

Walter Böhm
Department of Statistics
Univ. of Economics and Business Administration
Augasse 2-6
A-1091 Vienna, Austria
phone: +43-1-31336/4755
fax: +43-1-31336/774

Walter Böhm
(boehm@wu-wien.ac.at)

9. SIAM Annual Meeting 1998: Toronto, Canada, July 13-17, 1998

The 1998 Annual Meeting of the *Society for Industrial and Applied Mathematics* will be held at the University of Toronto, Canada, July 13-17, 1998. There is a partially overlapping SIAM Conference on Discrete Mathematics July 12-15 and *Society for Mathematical Biology* (SMB) will be running their annual meeting during the SIAM meeting. In addition the *Mathematical Association of America* (MAA) MathFest will be held, also in Toronto, on July 16-18.

The SIAM meeting will feature several invited talks including one by George Andrews on *The Deconstruction of Calculus Reform* as well as short courses and a rich variety of minisymposia.

Our Activity Group is planning a minisymposium on *Problems and Solutions in Special Functions* organized by Willard Miller and Martin Muldoon. Here is the description:

"Problem sections in journals such as SIAM Review and

the American Mathematical Monthly have been responsible for attracting many young people to the mathematical profession, by providing them with concrete and significant problems they can attack directly. Furthermore, problems sections have traditionally been influential in advancing mathematical research. At this time, when the SIAM Review is phasing out its problem sections, it is appropriate to assess the history and impact of the problems sections and their future evolution. Sponsored by the SIAM Activity Group on Orthogonal Polynomials and Special Functions."

Confirmed speakers so far are Cecil C. Rousseau, University of Memphis and Otto G. Ruehr, Michigan Technological University. Information will be maintained at our website (http://www.math.yorku.ca/siamopsf/) and distributed via opsftalk, see p. 21.

Another minisymposium of possible interest to our readers is *Symbolic-Numeric Algorithms for Polynomials* organized by Robert Corless and Stephen H. Watt.

Information on the SIAM meeting is available at http://www.siam.org/meetings/an98/an98home.htm

Martin Muldoon
(muldoon@yorku.ca)

10. International Workshop on Self-Similar Systems: Dubna, Russia, July 30-August 7, 1998

General Information: The *Bogoliubov Laboratory of Theoretical Physics* of the *Joint Institute for Nuclear Research* organizes an International Workshop 'Self-similar systems'. The workshop will be held in Dubna, a small quiet town surrounded by forest on the bank of the Volga river, 120 km north of Moscow. It will start on Thursday morning July 30 and end Friday August 7, 1998.

The Workshop will be devoted to diverse aspects of self-similar systems. The main attention will be paid to mathematically justified theories (the wavelet analysis, solvable models of self-organized criticality, quasicrystals, etc.). There will be a special session (around 5-6 August) devoted to the commemoration of the centenary of Ya. L. Geronimus. This will put a particular emphasis upon orthogonal polynomials (general theory and classical, semi-classical, Laguerre-Hahn polynomials, etc.).

An expected number of participants is 50-60, including a number of people invited by organizers and students. There will be review lectures of 45 min and shorter special seminars for experts. Selection of talks is by the advisory and organizing committees. Due to the interdisciplinary character of the workshop, there will be introductory mini-courses: *Time-frequency Analysis and Wavelets* by B. Torresani, *Wavelets and Multifractals* by S. Jaffard and *Discretizations in Lie Groups* by A. Iserles.

Topics to be covered:

- Wavelets and other self-similar functions
- Self-organized criticality
- Multifractals
- Orthogonal polynomials
- Eigenvalue problems with the singular continuous spectra
- Quasicrystals
- Self-structuring phenomena and turbulence
- Difference equations and numerical methods

Advisory Committee: R. Askey (Madison), D. Dhar (Bombay), A. Iserles (Cambridge), S. Jaffard (Paris), V.K. Mel'nikov (Dubna), J. Patera (Montreal), M. Schroeder (Göttingen), A.N. Sharkovsky (Kiev), K. Sneppen (Copenhagen).

Organizing Committee:
V.B. Priezzhev (priezzvb@thsun1.jinr.ru), V.P. Spiridonov (svp@thsun1.jinr.ru), A.L. Baranovski, L.B. Golinskii, E.N. Rusakovich, A.M. Povolotsky (scientific secretary).

Application: A registration should be returned to the scientific secretary by e-mail (povam@thsun1.jinr.ru) not later than March 31, 1998.

Mailing Address:

Prof. V.B. Priezzhev or Dr. V.P. Spiridonov
Bogoliubov Laboratory of Theoretical Physics
Joint Institute for Nuclear Research
141980 Dubna, Moscow region, Russia
Fax: (7-09621) 6-50-84
WWW: http://thsun1.jinr.ru/meetings/

Conference Fee: The Workshop fee for 10 days is 450 US$. It includes transportation from Moscow airports (or train stations) to Dubna (2 hours drive) and back, hotel accommodations (rates for double occupancy), coffee breaks, reception and a social program. For those who cannot participate for full length the fee will be reduced by an appropriate amount. The fee for accompanying persons is 200 US$. The number of supporting grants for students will be determined after obtaining responses from funding organizations. The fee will be accepted in cash during the registration in Dubna.

Vyacheslav Spiridonov
(svp@thsun1.jinr.dubna.su)

11. ICM: Berlin, Germany, August 18-27, 1998

Ian G. Macdonald (Queen Mary and Westfield College, University of London, England) is one of 21 mathematicians invited to give one-hour **Plenary Lectures** at ICM-98, the *International Congress of Mathematicians*, to be held in Berlin, Germany, August 18-27, 1998. This invitation was issued by the Organizing Committee on the recommendation

of the Program Committee appointed by the International Mathematical Union (IMU).

The Web page of the International Congress of Mathematicians is http://elib.zib.de/ICM98. This announcement is based on the URL http://elib.zib.de/ICM98/B/2.

Prizes and Awards

1. Steele Prize 1998 for Wilf and Zeilberger

On January 13, 1998 I received a message from Doron Zeilberger to his E-friends that Herbert Wilf and Doron Zeilberger were awarded the 1998 Steele prize. He added the responses of Herbert Wilf and himself to this prize, see below. I congratulate Herbert and Doron on this well-deserved award.

Tom H. Koornwinder
(thk@wins.uva.nl)

Generic Thanks and Expressions of Astonishment

On 11:05 PM, Dec. 24 (sic!) 1988, Herb Wilf called me up, and with Wilfian enthusiasm, told me how the beautiful one-line proofs of certain classical identities, generated by my beloved computer, Shalosh B. Ekhad, could be made even prettier, and how to obtain as a bonus, a 'dual identity', that is often much more interesting than the one originally proved. Thus was born WZ theory.

WZ theory has taught me that computers, by themselves, are not yet capable of creating the most beautiful math. Conversely, humans do much better math in collaboration with computers. More generally, combining different and sometimes opposite approaches and viewpoints will lead to revolutions. So the moral is: Don't look down on any activity as inferior, because two ugly parents can have beautiful children, and a narrow-minded or elitist attitude will lead nowhere.

We live in the great age of the democratization of knowledge, and even of that elitist ivory-tower called mathematics. Whoever would have believed, thirty years ago, that a 1988 Steele prize would go to Rota for his work in 'combinatorics' (a former slum), and whoever would have believed ten years ago that a 1998 Steele prize would go to W and Z for their work on 'binomial coefficients identities' (hitherto a slum squared).

The computer-revolution, and especially the World Wide Web, is quickly making mathematics accessible and enjoyable to many more people. Especially commendable are the wonderful website of Eric Weisstein's 'Eric's Treasure Troves', Steve Finch's pages on mathematical constants, the Sloane-Plouffe On-Line Encyclopedia of Integer Sequences, Simon Plouffe's 'Inverse Symbolic Calculator', and St. Andrews University's MacTutor site on the history of mathematics.

It is very important to make information, in particular mathematical, freely accessible. The pioneering, and extremely successful, Electronic J. of Combinatorics, created by Herb Wilf in 1994, should be emulated. It is very regrettable that the American Mathematical Society has subscription-only electronic journals, and that the electronic versions of its paper journals are only available to paper-subscribers. It is a disgrace that MathSciNet is only viewable for paying customers, thereby making its contents unsearchable by public search-engines.

On the positive side, the AMS has been very efficient in taking advantage of the electronic revolution, and the free ERA-AMS, under the leadership of Svetlana Katok, is a real gem!

I am really happy, not only for myself and Herb, but also because of the recognition that the field of hypergeometric series (alias binomial-coefficients identities) is hereby granted. There are so many giants on whose shoulders we are standing. Guru Dick Askey, q-Guru George Andrews, and Guru Don Knuth who preached the gospel from the continuous and discrete sides. Sister Celine Fasenmyer, a non-standard, yet very tall, giant. Hacker Bill Gosper who deserves this prize even more, and many others.

I should also mention our collaborators in this area: Gert Almkvist and Marko Petkovšek, and the beautiful work of Tewodros Amdeberhan, Fréderic Chyzak, J. Hornegger, Bruno Gauthier, Ira Gessel, Wolfram Koepf, Christian Krattenthaler, John Majewicz, Istvan Nemes, John Noonan, Sheldon Parnes, Peter Paule, Bruno Salvy, Marcus Schorn, Volker Strehl, Nobuki Takayama, P. Verbaeten, Kurt Wegschaider, and Lily Yen.

Finally, I must mention my main influencers, in roughly chronological order. My terrific seventh-grade math teacher, Devorah Segev, and my great eighth-grade history teacher (and principal), Matityahu Pines. My cousin Mati Weiss, who showed me Joe Gillis's 'Gilyonot leMatematika'. Joe Gillis, who in my early teens, first made me into a mathematician through his 'Gilyonot leMatematika'. My advisor, Harry Dym, who initiated me into research. My god-advisor, Dick Duffin, who discretized me. Leon Ehrenpreis, who dualized me. Joe Gillis (again!) who deranged me. Gian-Carlo Rota who umbralized me. Dick Askey, who hypergeometrized me. George Andrews who q-ified me. Herb Wilf (the same Herb!) who combinatorized me. Dominique Foata, who bijectified me. Jet Wimp, who asymptotized me. Xavier Viennot, who Schutzenbergerized me. Marco Schutzenberger, who formalized me. Bruno Buchberger, who basically standardized [grobnerized] me. Gert Almkvist who integralized me, and Pierre Cartier, who Bourbakised me. Let them all be blessed!

Doron Zeilberger
(zeilberg@euclid.math.temple.edu)

I am deeply honored to receive the Leroy P. Steele Prize. I might say that doing this research was its own reward—but it's very nice to have this one too! My thanks to the Selection Committee and to the AMS.

Each semester, after my final grades have been turned in and all is quiet, it is my habit to leave the light off in my office, leave the door closed, and sit by the window catching up on reading the stack of preprints and reprints that have arrived during the semester. That year, one of the preprints was by Zeilberger, and it was a 21st century proof of one of the major hypergeometric identities, found by computer, or more precisely, found by Zeilberger using his computer. I looked at it for a while and it slowly dawned on me that his recurrence relation would assume a self dual form if we renormalize the summation by dividing first by the right hand side. After that normalization, the basic "WZ" equation $F(n+1,k)-F(n,k) = G(n,k+1)-G(n,k)$ appeared in the room, and its self-dual symmetrical form was very compelling. I remember feeling that I was about to connect to a parallel universe that had always existed but which had until then remained well hidden, and I was about to find out what sorts of creatures lived there. I also learned that such results emerge only after the efforts of many people have been exerted, in this case, of Sister Mary Celine Fasenmyer, Bill Gosper, Doron Zeilberger and others. Doing joint work with Doron is like working with a huge fountain of hormones—you might get stimulated to do your best or you might drown. In this case I seem to have lucked out. It was a great adventure.

Herbert Wilf
(wilf@math.upenn.edu)

2. 1998 Popov Prize for Arno Kuijlaars

The following is based on a message from Prof. Jaap Korevaar (korevaar@wins.uva.nl) and on the URL http://math.vanderbilt.edu/events/approx.html. I congratulate Arno.

Tom H. Koornwinder
(thk@wins.uva.nl)

On January 4, 1998 Dr. A.B.J. ("Arno") Kuijlaars received the international Popov prize.

The second Vasil A. Popov Prize was awarded at the *Ninth Texas International Conference on Approximation Theory* held in January 1998 in Nashville, Tennessee. The prize has been established in memory of Vasil A. Popov and his contributions to approximation theory and related areas of mathematics.

The prize is awarded every three years for outstanding research contributions in fields related to Vasil Popov's work. Albert Cohen was the first recipient of the Vasil A. Popov Prize awarded in 1995. Eligibility for the current prize was restricted to mathematicians who did not have their terminal degree on June 1, 1991. The winner of the prize was asked to deliver a plenary lecture at the Texas conference.

The Selection Committee for the Vasil A. Popov Prize consisted of Charles Chui, Ronald A. DeVore, Paul Nevai, Alan Pinkus, Pencho Petrushev, and Edward Saff.

Arno received the prize for his innovating applications of potential theory to various problems from approximation theory. Nowadays this concerns in particular the accurate study of equilibrium distributions on a conductor in the presence of an exterior field; cf. [1].

Kuijlaars obtained his PhD in 1991 at the *University of Utrecht* on a topic from abstract potential theory, under the guidance of Prof. E.M.J. Bertin. He started with his present, more concrete work as a post-doc at the University of Amsterdam (1992-1995) under the guidance of Prof. J. Korevaar. He also worked for a short period with the well-known approximation theory specialist Prof. E. Saff at the University of South Florida (Tampa), with the numerical analyst Prof. W. Gautschi at Purdue University (Lafayette, Indiana) and with the approximation theory specialist Prof. W. Van Assche in Leuven (Belgium). At the moment he is working at the *City University of Hong Kong* with Prof. R. Wong. He will soon take up a more permanent position at the *Katholieke Universiteit Leuven*.

Arno Kuijlaars' current e-mail address is: maarno@math.cityu.edu.hk

References

[1] E.B. Saff and V. Totik: *Logarithmic Potentials with External Fields*. Grundlehren der Math. Wissenschaften, Vol. **316**, Springer, Berlin, 1997.

3. SIAM Student Paper Prizes

The annual SIAM Student Paper Prizes will be awarded during the 1998 SIAM Annual Meeting, July 13-17, at the University of Toronto.

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

The authors of the three best papers in applied and computational mathematics written by students and submitted to SIAM will present their papers at the meeting and will receive a $ 750 cash prize as well as gratis registration for the meeting. The winners will be awarded calligraphed certificates at a special prize ceremony at the meeting. Papers must be singly authored and not previously published or submitted for publication to be eligible for consideration. To qualify, authors must be students in good standing who have not received their PhDs at the time of submission.

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

Submissions must be received in the SIAM office on or before March 15, 1998.

Submissions, which must be in English, can be sent by regular mail or fax. Each submission must include

1. an extended abstract **not longer than 5 pages** (including bibliography);
2. the complete paper, which will be used solely for clarification of any questions;
3. a statement by the student's faculty advisor that the paper has been prepared by the author indicated and that the author is a student in good standing;
4. a letter by the student's faculty advisor describing and evaluating the paper's contribution; and
5. a short biography of the student.

Submissions will be judged on originality, significance, and quality of exposition.

The winners will be notified by June 1, 1998.

Please direct your submission and any questions you may have to A. Bogardo at SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688; tel. +1 215 382-9800; e-mail to bogardo@siam.org; fax to +1 215 386-7999.

Allison Bogardo
(bogardo@siam.org)

4. SIAM Student Travel Awards

During 1998, SIAM will make a number of awards for $ 300 to support student travel to each of the following SIAM conferences:

- Ninth Annual ACM-SIAM Symposium on Discrete Algorithms January 25-27, San Francisco, CA
- Fourth SIAM Conference on Control and Its Applications May 7-9, Jacksonville, FL
- Fourth International Conference on Mathematical and Numerical Aspects of Wave Propagation June 1-5, Golden, CO
- Ninth SIAM Conference on Discrete Mathematics July 12-15, Toronto, CANADA
- SIAM Annual Meeting July 13-17, Toronto, CANADA
- Industrial Workshop on Computer-Aided Design and Manufacturing October 22-23, Troy, MI

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

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

An application for a travel award must include:

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

Applications should be sent to the SIAM office (Attention: SIAM Student Travel Awards), 3600 University City Science Center, Philadelphia, PA 19104-2688. Students also may apply by e-mail to bogardo@siam.org or by fax to +1 215-386-7999.

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

Winners will be notified **five weeks** before the first day of the meeting. Checks for the awards will be given to the winning students when they arrive at the given meeting and check in at the SIAM Registration Desk.

Allison Bogardo
(bogardo@siam.org)

5. Call for Nominations: Reid Prize

The Reid Prize:

SIAM will present the W.T. and Idalia Reid Prize at the 1998 SIAM Annual Meeting in Toronto, Canada, July 13-17. The award will be given for research in, or other contributions to, the broadly defined areas of differential equations and control theory. The prize may be given either for a single notable achievement or for a collection of such achievements.

Eligibility:

The prize is awarded to any member of the scientific community who meets the general guidelines of the prize description above.

Description of Award:

The award consists of an engraved medal and a $ 10,000 cash prize.

Nominations:

A letter of nomination, including a description of achievement(s) should be sent by February 1, 1998 to:

Professor John A. Burns
Chair, Reid Prize Selection Committee
c/o Allison Bogardo
SIAM
3600 University City Science Center
Philadelphia, PA 19104-2688
Telephone: +1 215 382-9800
Fax: +1 215 386-7999
E-mail: bogardo@siam.org

Allison Bogardo
(bogardo@siam.org)

Books and Journals

Reviews

1. Elliptic Functions. A Constructive Approach
By Peter L. Walker
Wiley, Chicester–New York–Brisbane–Toronto–Singapore, 214 pp., 1996, ISBN 0-471-96531-6

This is a very remarkable book in which the theory of elliptic, i.e. doubly-periodic, functions is completely developed by direct manipulations of series, products and integrals. Hence the author takes a rather algebraical point of view which is primarily stimulated by Eisenstein's work.

Furthermore, to give a unified treatment, the author develops the theory of circular and related functions (like gamma) by the same method.

Indeed, the starting point for the circular and related functions are the families of series ($k \in \mathbb{Z}, k > 0$)

$$\sum_{n=-\infty}^{\infty} \frac{1}{(x+n)^k} \tag{1}$$

and

$$\sum_{n=0}^{\infty} \frac{1}{(x+n)^k} \ , \tag{2}$$

whereas the corresponding starting point for the elliptic functions is given by the family of double series ($k \in \mathbb{Z}, k > 0, \operatorname{Im}\tau > 0$)

$$\sum_{n=-\infty}^{\infty} \sum_{m=-\infty}^{\infty} \frac{1}{(x+m+n\tau)^k} \ . \tag{3}$$

Contents:

0. Preliminaries: Here a short introduction to series, products, and integrals is given.

1. Circular Functions: Starting with (1), the cotangent function, π and finally the other circular functions and their properties are developed.

2. Gamma and Related Functions: Using (2) instead of (1) yields the gamma and related functions.

3. Basic Elliptic Functions: Starting from (3), the Weierstrass elliptic functions are developed.

4. Theta Functions: Series similar to (3), e.g. with alternating sign, for $k = 1$ lead to the Jacobian theta functions.

5. Jacobian Functions: The Jacobian elliptic functions are ratios of Jacobian theta functions, and come next.

6. Elliptic Integrals: Elliptic integrals as inverses of elliptic functions are discussed now.

7. Modular Functions: Here, modular functions are treated. These are functions depending on the period ratio τ.

8. Applications: The use of elliptic functions in connection with waves, number theory and elliptic curves are discussed.

References

Index

I am very impressed by the author's treatment. It is rather striking how

1. the theories of the circular and the elliptic functions can be developed in much the same manner;
2. these developments can be done in such an algebraic way.

I recommend this book warmly to everybody who is interested in looking "behind the scenes" of elliptic functions.

Wolfram Koepf
(koepf@imn.htwk-leipzig.de)

2. Introduction to Combinatorics
By Martin J. Erickson
Wiley, Chicester–New York–Brisbane–Toronto–Singapore, xii + 195 pp., 1996, ISBN 0-471-15408-3

This is a book of eleven chapters introducing itself as a textbook. This review is written mainly from the point of view of evaluating it as such. This reviewer admits to preferring textbooks to be systematic and comprehensive. Some chapters of the present work tend to be sketchy rather than systematic. We begin with a description of the contents.

Chapter 1 is a collection of needed information about sets, group theory, linear algebra, and algebraic number theory. Sometimes the text can not quite decide between just stating facts with reference to well-known textbooks and actually giving definitions and some proofs. Some definitions should have been avoided: what does it gain to define a finite set as one having finitely many elements without defining "finitely" (or discussing bijections involving the basic sets $\{1, 2, 3, \ldots, n\}$)? In the rather important paragraph introducing the symmetric group the example of the cycle decomposition has the element "3" appearing in two cycles (one assumes that the second occurrence should have been "5", but this makes it difficult for a student to understand the concept). The standard binomial coefficient identities, like the Vandermonde sum, appear in this chapter, but the proofs tend to be too swift for a beginner and uninteresting for an expert.

Chapter 2 deals with the pigeonhole principle, has lots of detail and presents interesting examples, like good approximation to irrational numbers by rational ones. There is a brief introduction to graph theory (but it refers to planar graphs without giving a definition, except later in one

of the problems).

Sequences and partial orders are taken up in Chapter 3. The author displays more enthusiasm for the material here, which includes the Erdös-Szekeres and Sperner theorems. The proofs are complete but place some demands on the reader, like making a sketch or supplying more detail. This style holds throughout the book. Chapter 4 continues with the theme of existence theorems and takes up the topic of Ramsey numbers, graph colorings, probabilistic methods and van der Waerden's theorem on arithmetic progressions. These three chapters form the "existence" part.

The part on "enumeration" comprises Chapters 5 through 8. Counting problems are introduced mostly using function concepts like injections and surjections. The standard topics of Stirling numbers, Bell numbers, derangements and their generating functions are covered here. The unpleasant notation $[x]^n$ is used for the Pochhammer symbol $(x)_n$. In six pages, Chapter 7 discusses tableaux, hook-length formulas, and the Robinson-Schensted correspondence. This seems rather sketchy and may not be useful. On the other hand, Chapter 8 is a very good presentation of Pólya's theory of counting, with examples from graphs and cycle indices of permutations.

The third part of the book on "construction" comprises Chapters 9, 10 and 11, and presents linear codes, Hamming and Golay codes, t-designs, Latin squares, Hadamard matrices and the Leech lattice.

There is a bibliography of some sixty monographs and a six-page index. Also there are statements of open problems (most of them have been open for some time!) and selections of problems from past Putnam Competition Examinations.

As a textbook this work might be appropriate for an undergraduate seminar for upper level mathematics students or as a supplement in a graduate course. The coverage of Ramsey theory, Pólya's counting methods, codes and designs may be the strongest part of the book. Generally the proofs demand careful perusal by the reader and have more words than formulas; nevertheless the words are used very concisely! Every chapter has a section of problems, which tend to be difficult. Somehow the reader is left with the feeling of having been on a hasty tour of combinatorics without a satisfactory amount of detail in the reader's favorite part of the subject (whatever that might be). Indeed, similarly styled books have been designated as "essays", indicating a collection of personal insights and commentaries. This may be the better way of appreciating the present work.

Charles F. Dunkl
(cfd5z@virginia.edu)

Journals

1. New Journal: Fractional Calculus & Applied Analysis
Ed. by Virginia Kiryakova

The Editorial Board of *Fractional Calculus & Applied Analysis* (FCAA) (An International Journal for Theory and Applications) are pleased to announce the launching of this new journal (Vol. 1, 1998), specialized on the subjects:

Fractional Calculus, Integral Transforms, Special Functions and other closely related topics of Applied Analysis.

Addresses for contacts:

FCAA Journal
Dr. Virginia Kiryakova (Managing Editor)
Institute of Mathematics & Informatics
Bulgarian Academy of Sciences, Sofia 1090
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URL: http://alef.math.acad.bg/~fcaa

Virginia Kiryakova
(virginia@bgearn.bitnet)

Second Call For Papers

1. Orthogonal Polynomials and Computer Algebra
Journal of Symbolic Computation: Special Issue
Guest Editors: R. A. Askey, W. Koepf and T. H. Koornwinder

Academic Press, London

We would like to announce that the deadline for submissions of papers for the special issue of the *Journal of Symbolic Computation* on *Orthogonal Polynomials and Computer Algebra*, edited by R. A. Askey, W. Koepf and T. H. Koornwinder, has been extened until **February 28, 1998**.

I ask you to finish your papers and submit them within the next weeks.

The announcement can be also accessed at http://www.zib.de/koepf/jsc.

Wolfram Koepf
(koepf@imn.htwk-leipzig.de)

Software Announcements

1. q-Zeilberger Algorithm in Mathematica Updated

Dear q-experts !

I would like to inform you that a new version (1.8) of my Mathematica implementation of the q-Zeilberger algorithm

is available.

Besides several new features, the program is now **much** faster than previous versions. For instance, the rhs of identity (III.25) in the *Basic Hypergeometric Series* book by G. Gasper and M. Rahman, a ${}_{12}\phi_{11}$ series leading to a recurrence of order 3, can be solved now in less than 1 minute on a Pentium 100.

The package is accompanied by a Mathematica 3.0 notebook consisting of about 500 examples.

If you are interested in obtaining the update, please let me know whether you prefer receiving

- the file qZeil.tar.gz.uue (provided that you have tar, gzip and uudecode) or
- seven separate ASCII-files

by e-mail.

Axel Riese
(ariese@risc.uni-linz.ac.at)

2. Maple qseries Package

Folks:

I have written a Maple package called "qseries".

Documentation, installation instructions, files etc are available via WWW:

http://www.math.ufl.edu/~frank/qmaple/qmaple.html

The package contains a bunch of Maple programs for computing with q-series. At present, the main features are

- Conversion of q-series to infinite products of different types including eta-products and theta products.
- Generating probable algebraic relations (if they exist) among given q-series.

At present there is one version for UNIX and for Windows 3.1x (Hey - my PC at home runs Windows 3.1)

I have tested the programs on both Maple V Release 3 and Release 4 and they seem to work ok. Please report any bugs, typos, suggestions, compliments and complaints. Should I change the name of the package? Maybe I should call it `_qprods_` instead of `_qseries_`.

Frank G. Garvan
(frank@math.ufl.edu)

3. Revised Maple Packages on Hypergeometric and q-Hypergeometric Summation

Revised versions of our Maple packages on hypergeometric and q-hypergeometric summations (see Newsletter 6.1, p. 13, and Newsletter 7.3, p. 11) are available by e-mail request.

They contain implementations of Gosper's, Zeilberger's, Petkovšek's and related algorithms and their q-analogues, respectively.

Wolfram Koepf
(koepf@imn.htwk-leipzig.de)

Problems and Solutions

Thus far 18 problems have been submitted seven of which had been solved in previous issues (#**1**, **2**, **4**, **6**, **7**, **10**, **14**). In this issue the solution of Problem #**16** is presented. Still unsolved are Problems #**3**, **5**, **8**, **9**, **11**, **12**, **13**, **15**, **17** and **18**.

17. Canonical Leibniz' Formula for Difference Operators. Let Δ and ∇ be the usual forward and backward operators. The action on a product $f(x)g(x)$ is usually written in a nonsymmetrical (and nonunique) form, for instance:

$$\begin{aligned}\Delta[f(x)g(x)] &= f(x)\Delta g(x) + g(x+1)\Delta f(x)\\ &= g(x)\Delta f(x) + f(x+1)\Delta g(x)\ .\end{aligned}$$

A (unique) canonical form, without any shift on argument x, is sometime preferable to the nonsymmetrical formula, like

$$\Delta[f(x)g(x)] = f(x)\Delta g(x) + g(x)\Delta f(x) + \Delta f(x)\Delta g(x)\ ,$$

or

$$\nabla[f(x)g(x)] = f(x)\nabla g(x) + g(x)\nabla f(x) - \nabla f(x)\nabla g(x)\ .$$

Iteration of Δ or ∇ acting on a product of r functions $f_i(x)$ can obviously be written in the canonical form

$$\Delta^n\left[\prod_{i=1}^{r} f_i(x)\right] = \sum_{j_1\cdots j_r=0}^{n} R_n(j_1\cdots j_r)\prod_{i=1}^{r}\Delta^{j_i} f_i(x)\ ,$$

where the coefficients $R_n(j_1\cdots j_n)$ are nonnegative integers, invariant under the group of permutation P_r; ($S_n(j_1\cdots j_r)$ appears when using the operator ∇^n). Using two times the link with the shift operator E ($\Delta^n = (E-1)^n, E^k = (\Delta+1)^k$), the Δ^n canonical formula can be written:

$$\Delta^n\left[\prod_{i=1}^{r} f_i(x)\right] = \sum_{k=0}^{n}(-1)^k\binom{n}{k}\prod_{i=1}^{r}\left[\sum_{j=0}^{n-k}\binom{n-k}{j}\Delta^j[f_i(x)]\right].$$

Is it possible, using this representation, to obtain coefficients R_n (and S_n) in a closed form?

It is obvious that $R_n(0,\cdots,0) = R_n(s,0,\cdots,0) = R_n(0,s,0,\cdots,0) = \cdots = R_n(0,\cdots,0,s) = 0$, ($s = 1,\cdots,r-1$).
(Submitted on January 7, 1997)

André Ronveaux
(Andre.Ronveaux@fundp.ac.be)

18. Maclaurin Expansion. For $a, b \in (0,1)$ let

$$Q(a,b,r) = \frac{B(a,b)}{\log\left(\frac{c}{1-r}\right)}\, {}_2F_1\left(\begin{matrix} a, b \\ a+b \end{matrix} \middle| r \right)$$

where $B(a,b)$ denotes the Beta function, and

$$c = e^{R(a,b)}\ , \quad R(a,b) = -\Psi(a) - \Psi(b) - 2\gamma\ ,$$

γ is Euler's constant, and

$$\Psi(z) = \frac{\Gamma'(z)}{\Gamma(z)}\ .$$

Let

$$G(a,b,r) = \frac{Q(a,b,r)-1}{1-r} = \sum_{j=0}^{\infty} d_j\, r^j\ .$$

Is it true that all $d_j > 0$?

This question arose in connection with Theorem 1.4 in Trans. Amer. Math. Soc. 347 (1995), 1713–1723, which is a refinement of Ramanujan's asymptotic formula for the zero-balanced hypergeometric function ${}_2F_1$.
(Submitted on March 24, 1997)

Matti Vuorinen
(mv@geom.Helsinki.FI)

Solution to Problem 16
by Larry Glasser
(laryg@sun.mcs.clarkson.edu)

16. A Definite Integral. Prove that

$$\int_0^1 \frac{\log(\pi^2 + (\log x)^2)}{1+x^2}\, dx = \pi \log \frac{\sqrt{\pi/2}\,\Gamma(1/4)}{2\,\Gamma(3/4)}\ .$$

Remark: The integral is related to the Dirichlet L-function. The right side of this identity can be rewritten as

$$\frac{\pi\,(\gamma + 2\,\log(\pi/2))}{2} - 2\,L'(1)$$

where $L(s)$ is the Dirichlet L-function

$$L(s) = \sum_{k=0}^{\infty} \frac{(-1)^k}{(2k+1)^s}\ .$$

(Submitted on October 10, 1996 by Victor Adamchik)

The substitution $x = \exp(-u)$ leads to

$$\frac{1}{2}\int_0^{\infty} \log(\pi^2 + u^2)\,\mathrm{sech}(u)du\ .$$

This integral can be obtained from Binet's second integral (representation for the digamma function) by integration by parts, but is tabulated in Integrals and Series [1], Eq. (2.6.30(1)). Thus, the integral is related more to the logarithmic derivative of the Gamma function than to the L-function. Finally, Prudnikov's entry is actually equivalent to the generalization

$$\int_0^1 \frac{\log(a^2 + b^2\log^2(x))}{1+x^2}dx = \frac{\pi}{2}\log\frac{\Gamma^2(\frac{2a+3\pi b}{4\pi b})2\pi b}{\Gamma^2(\frac{2a+\pi b}{4\pi b})}\ .$$

References

[1] Prudnikov, A.P., Brychkov, Yu.A. and Marichev, O.I.: *Integrals and Series, Vol. 1.* Gordon and Breach Publ., New York, 1989.

The following problem proposed by Bozidar Anicin was published in the first issue 1998 of OP-SF Net 5.1.

Immediately after submission, John Boersma and Larry Glasser came up with solutions. We present the proposed questions and their solutions here:

Bessel Functions and Elliptic Integrals.
Problem A.
Prove, disprove or improve the following relation:

$$2I_1(a)K_1(a) = \int_0^{\infty} g(z)\cos(2az)dz \Big/ \int_0^{\infty} g(z)dz,$$

with $g(z) = g(k) = (2/k - k)K(k) - (2/k)E(k)$ where $K(k)$ and $E(k)$ are complete elliptic integrals of the first and second kind, respectively, with the modulus $k^2 = 1/(1+z^2)$. I_1 and K_1 are modified Bessel functions of the first order. The variable z is real, a is also real, but the possibility of complex a could also be considered.

Problem B.
With the notation introduced in Problem A, prove, disprove or improve the following relation

$$\int_0^{\infty} g(z)dz = \frac{\pi}{4}\ .$$

That the two relations are at least approximately correct, stems from electromagnetic theory. The left side in Problem A follows from Maxwell's theory, the right side comes from the theory of RLC networks, and the two sides represent the same physical quantity. Numerically, the integral in problem B is $\pi/4 - 0.002$ with an approximate integrand.
(Submitted on January 8, 1998 by Bozidar Anicin (anicin@EUnet.yu))

Solution

by John Boersma
(boersma@win.tue.nl)

Dear Dr. Anicin,

Here is a solution of your problem as published in the OP-SF NET 5.1, dated January 15, 1998.

Clearly, your function $g(z)$ is related to the Fourier cosine transform of $I_1(a)K_1(a)$. This transform is listed in [1, form. 1.12(47)]. By inversion of the latter transform one has

$$2I_1(a)K_1(a) = \frac{4}{\pi}\int_0^\infty Q_{1/2}(1+2z^2)\cos(2az)\,dz$$

and, for $a = 0$,

$$1 = \frac{4}{\pi}\int_0^\infty Q_{1/2}(1+2z^2)\,dz\ .$$

Next, the Legendre function $Q_{1/2}$ is expressible in terms of elliptic integrals $K(k)$ and $E(k)$:

$$Q_{1/2}(1+2z^2) = \left(\frac{2}{k} - k\right)K(k) - \frac{2}{k}E(k)$$

where $k = (1+z^2)^{-1/2}$; see e.g. [2, form. 8.13.7]. I believe this completely solves your problem.

References

[1] Erdélyi, A., Magnus, W., Oberhettinger, F. and Tricomi, F.G.: *Tables of Integral Transforms, Vol. 1.* McGraw-Hill, New York, 1954.

[2] Abramowitz, M. and Stegun, I.A.: *Handbook of Mathematical Functions.* Dover Publications, New York, 1965.

Solution

by Larry Glasser
(laryg@sun.mcs.clarkson.edu)

Dear Dr. Anicin,

Your problem is actually equivalent to a well known integral. Since

$$\int_0^\infty \cos(xz)I_1(x/2)K_1(x/2)dx = g(k)$$

(This follows for example from Prudnikov et al., *Tables of Integrals and Series*, Vol. 2 (2.16.30.3)). Hence, by Fourier inversion,

$$\int_0^\infty \cos(2az)g(z)dz = \frac{\pi}{2}I_1(a)K_1(a).$$

In particular, for $a \to 0$ you get the solution to problem B.

Miscellaneous

1. Problem Section in SIAM Review

Here is a collection of remarks on SIAM's proposal to stop the *Problem Section* in *SIAM Review* continuing the discussion in Newsletter 7-3, pages 15-16, followed by an answer by the Journals Publisher Mary Rose Mucci from SIAM.

Note that our Activity Group plans a minisymposium on *Problems and Solutions in Special Functions* during the SIAM Annual Meeting in Toronto in July 1998 (see p. 10).

SIAM Review Should Not Cancel its Problem Section

Cecil Rousseau, the problem editor of SIAM Review, has just told me that SIAM Review's problem section's days are numbered. I was shocked, but not surprised. I have already had a premonition of that, a few months ago, when I read in SIAM News that SIAM Review is about to get a 'face lift' and a 'new image'. I am always wary of such proposed improvements that contribute to the contemporary trend to sacrifice content in favor of fluff and 'image'. It is regrettable that even scientists, and mathematicians to boot, have caught the image-obsession that has turned politicians into puppets in the hands of sleazy PR-professionals.

The most interesting parts of the *American Mathematical Monthly* and *SIAM Review* are their problem sections. Nobody reads the articles, but many readers go straight to the problem section. Almost as interesting as the problems are the solutions. One of my favorite books is Klamkin's collection of problems from SIAM Reviews. Even from the snobbish, prestige-hungry, point of view of the SIAM administration, there is justification for the problem section. For example, Mehta's famous integral (that turned out to follow from Selberg's once-dormant 1944 paper), made its first appearance as a problem in SIAM Review. Similar things can be said about Monthly problems, for example, Erdös's problem from 1946 that started Euclidean Ramsey theory, and the famous Busseman-Petit conjecture that was first raised as a Monthly problem.

But, most importantly, Problem sections turned many young people into mathematicians. It was the late Joe Gillis's 'Gilyonot leMatematika' (and that hopefully still exists today), and especially its problem section, that made me, and many of my friends in Israel, into mathematicians.

I also feel a personal loss. My first 'publication', in 1970, when I was an undergrad, was a solved problem in SIAM Review. Both the problem and my solution were real gems. I'll forget my right hand before I'll forget it. Let G be a finite group with n elements, and let S be any subset. Prove that S^n is a subgroup. My solution went as follows. When $|S| = 1$ it is trivial. Otherwise, by pigeon-hole, there must be an i such that $|S^i| = |S^{i+1}|$, hence $S^{i+1} = aS^i$, for some a in G, and hence $S^n = a^{n-i}S^i, S^{2n} = a^{2n-i}S^i = a^nS^n = S^n$, hence $(S^n)^2 = S^n$ and S^n is a subgroup. I was so proud and delighted when I first solved it, and was really ecstatic when Murray Klamkin decided to publish my solution. I am sure that many had a similar experience.

In conclusion, let me quote Herb Wilf, who in a recent bio in the Monthly wrote (AMM 104 no. 6 (June-July 1997), p. 588):

"Herbert Wilf has been editor of this Monthly, and remembers well how the 'Problems and Solutions' tail often wagged the Monthly dog'. The same is true of SIAM Review, and it is a very stupid dog-owner that chops his dog's tail, especially one that wags so well."

Doron Zeilberger
(zeilberg@euclid.math.temple.edu)

Let me second Doron Zeilberger's comments about the Problem Section in SIAM Review. He is wrong about Mehta's problem first appearing in SIAM Review's Problem Section, since it had appeared in a joint paper with Freeman Dyson. However, no one could solve it and it was completely missed by mathematicians in their paper in J. Math. Physics, so it was important to have it appear in SIAM Review to bring it to the attention of mathematicians who might have been able to solve it. Eventually, a direct evaluation of this integral was found which did not have to go to the more general integral of Selberg. The argument used to evaluate this integral directly was also used to evaluate some finite sums of real interest and the argument found by Selberg and a later argument of Aomoto, which appeared in SIAM J. Math. Anal. do not work in the finite character sum case. Cecil Rousseau had sent me Mehta's problem to referee for SIAM Review, and I spent a fair amount of time trying to solve it. If I had not, it is not clear that I would have appreciated Selberg's integral as I did, and found some conjectured extensions of it. These were published in SIAM J. Math. Anal., and eventually proven. Thus a problem in a problem section can be useful even if no one is able to solve it because of its publication in a problem section. Doron's point about young people being attracted to a subject by problems they can work on is important. It might be useful for SIAM to set up a student problem section. I hope that the problems were not dropped because they do not correspond to the type of problem which the officers think arises in applied mathematics, for I can assure them that many of the problems involving special functions which have appeared in SIAM Review are similar to those that are sent to me by mathematicians and others who come across them in their applied work. Just today, someone was here to talk about inverse problems, and Lommel polynomials arose in a very natural way. Their orthogonality relation may be important in trying to solve the original inverse problem. The orthogonality appeared in a paper in Proc. Amer. Math. Soc., but it easily could have been a problem in SIAM Review. I do not agree with all of the arguments given by Zeilberger about why this problem section was stopped, but agree with him that this is unfortunate.

Richard Askey
(askey@math.wisc.edu)

I would like to echo Doron Zeilberger's strong support for the SIAM problem section. Please also remember that many more people look at and discuss these problems than submit solutions.

Jonathan Borwein
(jborwein@cecm.sfu.ca)

I completely agree with Doron.

N. J. A. Sloane
(njas@research.att.com)

Good; I'm glad that you are after them on this. Just because the editors now wear long trousers, it doesn't mean there aren't short trousered kids coming along who can't benefit from the fun of solving problems.

Andrew Granville
(andrew@sophie.math.uga.edu)

I agree completely with your opinion.

Andrew Odlyzko
(amo@research.att.com)

I am writing in order to fully support Doron Zeilberger's "Opinion 19" - "SIAM Review Should Not Cancel its Problem Section".

Peter Paule
(ppaule@risc.uni-linz.ac.at)

SIAM would like to thank the members of the Orthogonal Polynomials and Special Functions activity group for their interest in and support of Problems and Solutions. We are happy to know that you have such a high regard for the section and would like to take this opportunity to clarify SIAM's plans for the future of Problems and Solutions.

While it is true that the Problems and Solutions will no longer be included as part of SIAM Review, the section has not been eliminated. Because of its format and audience, SIAM has designated Problems and Solutions as its first electronic-only publication. Problems and Solutions will continue on the World Wide Web in 1999 and beyond.

Many of you have pointed out that the Problems and Solutions are particularly useful to students and younger researchers and may help to entice young people to become mathematicians. We believe that an electronic format will appeal to these younger researchers and entice them to solve the problems and submit their solutions. We also hope that the wide readership possible with a free, web-based publication will bring the Problems and Solutions to the attention of students, researchers, and other interested parties who may not have had the opportunity to read the section in SIAM Review.

The Problems and Solutions will be available freely to everyone. They will not be part of SIAM Journals Online, which cannot be accessed without a subscription.

For the immediate future, we anticipate the submission and review procedures for Problems and Solutions to continue as they are now. The editor(s) will continue to take submissions of both problems and solutions, choose the best ones, and send them to SIAM. SIAM will publish the Problems and Solutions individually on the web in PDF format with an HTML table of contents listing the titles and authors. Therefore readers will be able to click on the title of the problem or solution that interests them and go right to it. We will also print the names of the problem proposers and solvers regularly in a SIAM publication.

SIAM News or the Education section of SIAM Review have been suggested as appropriate places to publish them.

There are many things we would like to do with the electronic Problems and Solutions section in the future, such as allowing people to submit both problems and solutions electronically via the web and linking to related material. But given SIAM's current capabilities and the existing electronic publishing system, our initial proposal is fairly straightforward. We know that we can follow the procedures outlined above with our current electronic publishing setup. As that evolves we may be able to expand and update the way the Problems and Solutions section works.

The Orthogonal Polynomials and Special Functions Activity Group has been steadfast in its support of Problems and Solutions. We would be pleased if the activity group became involved in the electronic version. I encourage you to contact me directly if you have ideas for possible involvement, additional comments, or questions about what is outlined above. Thank you again for your support of Problems and Solutions.

Mary Rose Mucci
(muccie@siam.org)

2. PhD Project on History of Orthogonal Polynomials

I found the following announcement of a PhD project at URL's http://www.math.rug.nl/vac/vacancies.html and http://www.math.rug.nl/vac/maanen.html.

At this moment 7 PhD and 1 Bursary positions are available at the *Research Institute of Mathematics and Computing Science* (IWI) of the University of Groningen (Netherlands). Positions could be obtained in several specified research areas, one of which is the following:

The history of orthogonal polynomials. Project leaders: Aad Dijksma and Jan van Maanen (contact person, e-mail J.A.van.Maanen@math.rug.nl).

The aim of the project is to investigate various aspects of the historical development of orthogonal polynomials (OP). The following aspects will be taken into account:

chronology: the chronology starts at about 1750, with the competitive work of Laplace and Legendre as a first major event.

biography: already the fact that most of the special functions bear the names of mathematicians suggests the relevance of the biographical aspect. Competition and collaboration will be topics to focus at.

applications: the origin of several of these functions is closely linked to applications, ranging from probability theory to potential theory.

changing roles: from functions with interesting properties with respect to integration the orthogonal functions became elements in a vector space with inner product. This also changed the way in which mathematicians could 'play' with them.

The objective is to write a 'Microstoria'. The Microstoria-method takes a restricted and clearly recognizable subject as a starting point and uses it as a kernel for writing more general history. The time span of the subject (1750-1950), the involvement of several major mathematicians, the regular use of OP in applied situations, the tendency to unify the theory of OP and to cover the individual polynomials under a common heading, the handbook tradition, are themes which, in combination with each other, will lead to a fresh description of the history of modern mathematics. Up to now there have been partial studies in this field (e.g. by Szegö (1958), Askey (1988), and Meijer(1996)), but an overview is lacking. To produce such an overview, which at the same time will be a 'Microstoria' about mathematics in general, is the central aim of the project.

Tom H. Koornwinder
(thk@wins.uva.nl)

3. Starting a new Listserv for Discussions on OP & SF

As announced in OP-SF NET 4.6, Topic #27, **opsftalk**, a discussion forum in orthogonal polynomials and special functions, is now open for business. To subscribe, send a message to

majordomo@wins.uva.nl

and put in the body of the message only the words:

subscribe opsftalk

You can post messages by sending mail to

opsftalk@wins.uva.nl

Your message will then be automatically forwarded to everybody on the opsftalk list.

Starting January 13, 1998, Tom Koornwinder is archiving postings to opsftalk at the URL

http://turing.wins.uva.nl/~thk/opsftalk/archive.html

If the frequency of postings increases, then another (automatized) solution for the archiving will be sought.

Many of the contributions to opsftalk will form the basis for Topics in OP-SF NET.

Martin Muldoon
(muldoon@yorku.ca)

4. Preprint Archive in Classical Analysis

I call your attention to a recent restructuring of electronic archives for preprints in Mathematics, like the existing q-alg. Read more about this in http://xxx.lanl.gov/new/math.html.

One of the proposed new archives is:

CA Classical Analysis:

> Harmonic analysis, approximations, series, expansions, asymptotics, classical transforms, special functions, differential relations, exact ODE's, calculus of variations.

Tom H. Koornwinder
(thk@wins.uva.nl)

How to Contribute to the Newsletter

Send your Newsletter contributions directly to the *Editor:*

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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.

Deadline for submissions to be included in the June issue 1998 is May 15, 1998.

Back issues of the Newsletter can be obtained from http://www.zib.de/koepf/siam.html .

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

The Net is organized by Tom Koornwinder (thk@wins.uva.nl) and Martin Muldoon (muldoon@yorku.ca). Back issues of OP-SF Net can be obtained by anonymous ftp from `ftp.wins.uva.nl`, in the directory

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

or by WWW at the addresses

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

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

Martin Muldoon, moreover, manages our home page

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

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

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

Activity Group: Addresses

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

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

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