On the cover: The Jardines del Turia, founded in 1986, and located at $39.4800°\text{N}, 0.3861°\text{W}$, is the largest urban park in Spain.

The ICIAM Dianoia
Vol. 6, No. 4, October 2018

The ICIAM newsletter was created to express the interests of our membership and partner organizations and the views expressed in this newsletter are those of the authors and do not necessarily represent those of ICIAM or the Editorial team. We welcome articles and letters from members and associations, announcing events, on-site reports from events and industry news. www.iciam.org

ICIAM Announcements

Suggestions for Possible Members of The Scientific Program Committee for The ICIAM 2023 Congress

Following the rules voted in previous Board meetings, ICIAM members societies are asked to propose names for possible members of the SPC for the Tokyo ICIAM 2023 Congress. Presidents and Representatives of all member societies will receive a message from the ICIAM President asking them to do so. The deadline for sending the suggestions will be February 1, 2019.

Following the rules, taking into consideration the suggestions of the member societies, the ICIAM President chairs a discussion with the ICIAM Officers and the SPC Chair in order to draw up, by consensus, a suggestion for the composition of the SPC. The Congress Director serves as an ex-officio member in the discussion.

About the New International Science Council

The First President is an Applied Mathematician

On July 3–5, 2018 the first General Assembly of the International Council for Science (ISC) took place in Paris. ISC is a new international body, born from the merger of ICSU (International Council for Science) and the ISSC (International Social Science Council). This new body aims at representing all sciences, to be a global voice for science and to advance science as a global public good. As stated on the ISC website "scientific knowledge, data and expertise must be universally accessible and its benefits universally shared. The practice of science must be inclusive and equitable, also in opportunities for scientific education and capacity development." ISC is a non-governmental organization that brings together 40 international scientific Unions and Associations and over 140 national and regional scientific organizations including Academies and Research Councils.

The Council's goals are twofold. On one hand, to stimulate and support international scientific research on major issues of global concern, to coordinate studies and efforts in those directions. On the other hand, the Council aims to promote the rigor and the relevance of science to analyze complex situations, and to speak for the value of all science and evidence-informed decision-making.

Many of the participants in the General Assembly insisted on the fact that the Council should not reproduce what is already done or attempted by the individual scientific unions or national bodies but should instead concentrate on topics of global relevance and on the coordination of efforts at the international level.

The second axis is of importance since "fake news" and the use of pseudo-science to analyze situations or back decisions are becoming an issue. It is very common to see superficial and totally non-scientific reasoning in the media and on social media. Science, real science, has to be defended and presented as the only way to understand reality, and propose solutions to the existing issues.

To make these goals of the Council clearer, let us add that its activities are presented as "science for policy" and "policy for science," thus stressing the two ways that must be followed for strengthening the role of science in our societies.

Another big theme in the presentation of the Council's goals and activities was related to the fierce defense of the free and responsible practice of science. This includes concerns on the way in which science is currently evaluated, the need for science to be free and accessible worldwide. Further, ISC works towards filling the gender and economic gaps which prevent many potential researchers from participating in the quest for science.

The Council co-sponsors international research studies, networks, and committees. Has several regional offices in the world and its activities are mainly centered around the following important topics: global sustainability, poverty, urban health and wellbeing, and disaster risk reduction, data, observing systems, and providing science advice to governments. The main goal is to understand issues of importance with a scientific methodology and get ready to advise decision makers on important global decisions.

The first day of the General Assembly was spent discussing and presenting the new organization and its structure, goals, and functioning to all its members. A large part of the second day was devoted to the election of the officers and members at large of the governing Board of ISC. In particular Professor Daya Reddy, an applied mathematician from South Africa, was elected as first president of ISC.

ICIAM, associate member of ICSU, and now affiliate member of ISC, was represented in the General Assem-

bly by its president, Maria J. Esteban, and by Gabriella Puppo, a member of the ICIAM ISC Committee.

The last day was a Science Day, it was open to non-members and was devoted to a series of presentations and debates about the values of science and its links with politics and the society. It was an extremely interesting day, where top scientists in different fields spoke about topics of interest to the new Council. This included keynotes from Craig Calhoun, Esther Duflo, Ismail Serageldin, and Cédric Villani. Some government figures also gave presentations about the importance of science for our societies. After each keynote presentation a debate took place and all of them were extremely lively and each time it was difficult to bring the conversation to a halt.

This event marked the end of a very rich three-day meetings and events, all hosted by the French Academy of Sciences. Indeed, the Council main offices are situated in Paris and the French Government is supporting them, through the French Academy.

Mathematicians, and scientists in general, should be more aware about not only the global voice of the ISC, but also the opportunities that it provides to interact with other sciences and propose solutions to global issues concerned with the future of our planet and our societies. The ISC should also be better known by decision makers and the Council's advice should be sought when important policies are designed at national or international levels on pertinent subjects.

Maria J. Esteban, ICIAM President
Gabriella Puppo, member of ICIAM ISC Committee

Maria J. Esteban is a senior researcher at CNRS and works at the University Paris-Dauphine. Her research themes include the study of nonlinear partial differential equations, especially by variational methods; relativistic and nonrelativistic quantum mechanics, with applications to quantum chemistry; fluid-structure interactions, etc. Currently she is the president of ICIAM.

Gabriella Puppo teaches numerical analysis at the University of Insubria, in Como (Italy). Her research interests span from numerical methods for hyperbolic equations to algorithms and models in kinetic theory, both in gas dynamics and social sciences, such as numerics and models for traffic flow. Her research focuses in the construction of high order numerical methods, and in the preservation of steady states and asymptotic limits at the discrete level. She is also interested in projects for disseminating scientific awareness.

The Gender Gap Project: Global Survey of Scientists

by Jean Taylor

The 2018 Global Survey of Scientists is now underway and will be open until October 31, 2018. All people in the fields of Mathematical, Computing, and Natural Sciences, including students, are encouraged to go to the link `statisticalresearchcenter.org/global18`, which redirects to a secure site. The survey is available in seven languages (English, French, Russian, Spanish, Arabic, Chinese, and Japanese); simply choose your language on the first page of the survey.

The survey is part of an interdisciplinary collaboration of eleven partners (including ICIAM) which aims to better understand the problems that Mathematical, Computing, and Natural Science academics and practitioners are facing around the world. One of the specific tasks for the project is to collect data across the world to inform policy makers from all countries, especially developing countries, about reducing the gap between men and women in mathematical, computing, and natural sciences. The survey data are being collected by the nonprofit Statistical Research Center of the American Institute of Physics. Responses to this survey are voluntary, and individual information will be held in strict confidence. The project is primarily supported by the International Council for Science (ICSU).

The survey was honed through regional meetings, held over the past year in Taiwan, Capetown, and Bogota and involving scientists worldwide. These regional meetings also discussed another aim of the Gender Gap Project, which is to assemble a list of best practices and links to other sites that have such lists. The second coordination meeting for the whole project was held in Paris June 11–12, 2018; there will be two more meetings in 2019, where the project will be wrapped up and the results disseminated.

Jean E. Taylor, coordinator for ICIAM

2018 GLOBAL SURVEY

OF MATHEMATICAL, COMPUTING, AND NATURAL SCIENTISTS

The 2018 Global Survey of Scientists is looking for respondents in the fields of astronomy, biology, chemistry, computing sciences, the history and philosophy of science and technology, mathematics, and physics. The goal of this **global, multicultural, and multidisciplinary survey** is to study social dynamics in these fields. The analysis will compare scientists' and practitioners' experiences, challenges, and interests across regions, countries, disciplines, sector of employment, and career stage. The insights gained will help the International Science Council and its member unions recommend interventions to increase participation of all people in STEM fields.

We need women and men in mathematical, computing and natural sciences at all levels, including students, to share their career and education experiences.

The survey is available in seven languages and was developed with input from the three major regions of the ISC Regional Offices — Africa, Asia and the Pacific, and Latin America and the Caribbean.

http://statisticalresearchcenter.org/global18

Your confidential responses will help us develop a broader picture of the status of mathematical, computing, and natural scientists across the world, as well as focused information about women in these fields. The data you contribute will help create informed interventions to increase participation, especially for women.

FREQUENTLY ASKED QUESTIONS

Who should answer? People in mathematical, computing and natural sciences at all levels, including students, should share their career and education experiences. This survey is intended for anyone served by the following unions:

- International Mathematical Union (IMU)
- International Union of Pure and Applied Chemistry (IUPAC)
- International Union of Pure and Applied Physics (IUPAP)
- International Astronomical Union (IAU)
- International Union of Biological Sciences (IUBS)
- International Council for Industrial and Applied Mathematics (ICIAM)
- International Union of History and Philosophy of Science and Technology (IUHPST)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Gender in Science, Innovation, Technology and Engineering (GenderInSITE)
- Organization of Women in Science for the Developing World (OWSD)
- Association for Computing Machinery (ACM)

Who is conducting the survey? The Gender Gap in Science project, funded by the International Science Council, is a collaboration among the organizations listed above.

Why should you answer? The project is collecting data to develop a broader picture of the status of mathematical, computing, and natural scientists across the world, as well as focused information about women in these fields. The data that you contribute will help inform interventions by ISC and member unions to increase participation, especially for women.

Are my data confidential? Yes. All individual responses are kept confidential. Staff members at the Statistical Research Center of American Institute of Physics (AIP), who have already conducted three global surveys of physicists, collaborated with the project partners to develop the questionnaire. The survey is hosted on AIP's secure server and data will be stored and analyzed according to AIP policy and following U.S. law for the protection of human subjects.

If you have any questions, please contact John Tyler of the Statistical Research Center at the American Institute of Physics at: **jtyler@aip.org**

AIP
American Institute of Physics

Press Release: 2019 ICIAM Prizes Announced

The International Council for Industrial and Applied Mathematics (ICIAM) is pleased to announce the winners of the five ICIAM Prizes for 2019.

ICIAM is a worldwide organization for professional applied mathematics societies, and for other societies with a significant interest in industrial or applied mathematics. The aims of the Council are

- to promote industrial and applied mathematics globally;
- to promote interactions between member societies;
- to promote the goals of these members societies;
- and to coordinate planning for periodic international meetings on industrial and applied mathematics.

The ICIAM Congresses, held every four years, are run under the auspices of the Council. The 2019 Prizes will be presented at the next ICIAM Congress, ICIAM 2019, the Nineth International Congress on Industrial and Applied Mathematics, which will take place in Valencia, Spain, July 15–19, 2019.

About the Prizes Prize winners were selected by the ICIAM Prize Committee. The members of the Committee for the 2019 were: Alexandre Chorin, Maria J. Esteban (Chair), Alexander Mielke, Zuowei Shen, Zdeněk Strakoš, Denis Talay, Margaret H. Wright.

The Collatz Prize was established to provide international recognition to individual scientists under 42 years of age for outstanding work on industrial and applied mathematics. It was created on the initiative of GAMM (Gesellschaft für Angewandte Mathematik und Mechanik), and first awarded in 1999. Carrying a cash award of USD 5000, the Collatz Prize is presently funded by GAMM. The subcommittee for the 2019 ICIAM Collatz Prize was: Zdeněk Strakoš (Chair), Albert Cohen, Thomas Grandine, Motoko Kotani, Art B. Owen, Ulrich Rüde.

The 2019 ICIAM Collatz Prize is awarded to **Siddharta Mishra** (Department of Mathematics, ETH Zürich, Switzerland) for his breakthrough contributions that skillfully combine modelling of real world problems and rigorous mathematical analysis with the development of efficient and accurate numerical schemes and high performance computing.

The Lagrange Prize was established to provide international recognition to individual mathematicians who have made an exceptional contribution to applied mathematics throughout their careers. It was created on the initiative of SEMA (Sociedad Española de Matematica Aplicada), SIMAI (Società Italiana di Matematica Applicata e Industriale), and SMAI (Société de Mathématiques Appliquées et Industrielles), and first awarded in 1999. The SBMAC (Sociedade Brasileira de Matemática Aplicada e Computacional) joined the group of sponsors in 2017. Carrying a cash award of USD 5000, the Lagrange Prize is presently funded by the four member societies SBMAC, SEMA, SIMAI, and SMAI. The subcommittee for the 2019 ICIAM Lagrange Prize was: Alexandre Chorin (Chair), Marsha Berger, Lei Guo, Laure Saint-Raymond, Christof Schütte, Simon Tavaeé.

The 2019 ICIAM Lagrange Prize is awarded to **George Papanicolaou** for his brilliant use of mathematics to solve important problems in science and engineering; in particular, problems involving inhomogeneity, wave propagation, random media, diffusion, scattering, focusing, imaging, and finance.

The Maxwell Prize was established to provide international recognition to a mathematician who has demonstrated originality in applied mathematics. It was created on the initiative of the IMA (The Institute of Mathematics and its Applications) with the support of the J.C. Maxwell Society, and first awarded in 1999. Carrying a cash award of USD 5000, the Maxwell Prize is presently funded by IMA. The subcommittee for the 2019 ICIAM Maxwell Prize was: Alexander Mielke (Chair), Eric Cancès, Karl Kunisch, Michael Kwok-Po Ng, Kavita Ramanan, Edriss Titi.

The 2019 ICIAM Maxwell Prize is awarded to **Claude Bardos** for his seminal contributions to nonlinear partial differential equations, kinetic theory, and mathematical fluid mechanics.

The Pioneer Prize was established for pioneering work introducing applied mathematical methods and scientific computing techniques to an industrial problem area or a new scientific field of applications. It was created on the initiative of SIAM (Society for Industrial and Applied Mathematics), and was first awarded in 1999. Carrying a cash award of USD 5000, the Pioneer Prize is presently funded by SIAM. The subcommittee for the 2019 ICIAM Pioneer Prize was: Denis Talay (Chair), Luca Formaggia, Alain Goriely, Dorit S. Hochbaum, Barbara Kaltenbacher, Carlos Vázquez.

The 2019 ICIAM Pioneer Prize is awarded to **Yvon Maday** (Sorbonne University, Paris, France) in recognition of his leading role in the introduction of powerful methods for numerical simulation, such as spectral methods, reduced order modeling, domain decomposition, models and simulation in medical sciences, fluid-structure interaction, and ab-initio chemistry. Several of his works helped in the launching of start-ups and are intensively used in industry.

The Su Buchin Prize was established to provide international recognition of an outstanding contribution by an individual in the application of Mathematics to emerg-

ing economies and human development, in particular at the economic and cultural level in developing countries. It was created on the initiative of the CSIAM (China Society for Industrial and Applied Mathematics), and was first awarded in 2007. Carrying a cash award of USD 5000, the Su Buchin Prize is presently funded by CSIAM. The subcommittee for the 2019 ICIAM Su Buchin Prize was: Zuowei Shen (Chair), Kirk E. Jordan, Bernd Krauskopf, Hyung-Chun Lee, Claudia Sagastizabal.

The 2019 ICIAM Su Buchin Prize is awarded to **Giulia Di Nunno**, for her long-lasting record of actively and efficiently encouraging top-level mathematical research and education in developing African countries.

ICIAM 2019 Prize Winners

ICIAM COLLATZ PRIZE

COLLATZ PRIZE: Siddhartha Mishra.

Siddhartha Mishra is the winner of the 2019 ICIAM Collatz Prize, for his breakthrough contributions that skillfully combine modelling of real world problems and rigorous mathematical analysis with the development of efficient and accurate numerical schemes and high-performance computing.

Siddharta Mishra was born in 1980 in India, studied mathematics at the IISc and the Tata Institute in Bangalore. After holding positions at the University of Oslo and ETH Zürich, in 2012 he became, at age 32, tenured professor at ETH Zürich and Professor II at the University of Oslo. In 2012 he received an ERC Starting Grant and in 2015 the prestigious Richard-von-Mises Prize awarded by GAMM. He was a plenary speaker at HYP 2012, the most important conference in his field, and an invited speaker at ICM 2018.

Siddhartha Mishra is an ingenious designer of excellent numerical methods, mainly for systems of hyperbolic conservation and balance laws and has a deep understanding of their mathematical and physical background. He has produced codes for complicated realistic problems with realistic data; for example, tsunamis generated by rock slides and waves in the solar atmosphere. He uses numerical experiments to get insight into the analysis of partial differential equations. In particular, together with his former student U.S. Fjordholm, and with R. Käppeli and E. Tadmor, he showed that in fluid dynamics the Kelvin-Helmholtz instability is due to physics and not to numerical schemes. This has led them to invent a scheme to numerically approximate measure-valued solutions of hyperbolic conservation laws, and has resulted in the first proof of convergence to entropy measure-valued solutions of the compressible Euler equations in several space dimensions. On the way, Mishra and co-workers made several seminal breakthroughs: a proof that Essentially-Non-Oscillatory (ENO) reconstruction is stable (this was an open problem for about 25 years); the creation of the TeCNO scheme — the first stable scheme of arbitrarily high order for multidimensional nonlinear systems of conservation laws; and development of the concept of multilevel Monte Carlo methods for uncertainty quantification for nonlinear hyperbolic systems. With others, he designed well-balanced schemes for stratified Euler and MHD equations and, with Le Floch, methods with well-controlled dissipation for shock-capturing computations.

Siddhartha Mishra is devoted to combining rigorous mathematics with efficient computations that are based on a deep theoretical knowledge and insight into real-world problems.

ICIAM LAGRANGE PRIZE

George Papanicolaou is the winner of the 2019 ICIAM Lagrange Prize, for his brilliant use of mathematics to solve important problems in science and engineering; in particular, problems involving inhomogeneity, wave propagation, random media, diffusion, scattering, focusing, imaging, and finance.

George Papanicolau is the Robert Grimmett Professor of Mathematics at Stanford University. He received his B.E.E. degree from Union College in Schenectady,

NY, in 1965, and his M.S. in 1967 and PhD in 1969 from the Courant Institute of New York University. He was a member of the faculty of the Courant Institute during the years 1969–1993, and moved to the department of mathematics at Stanford in 1993. He has been awarded a Sloan Fellowship and a Guggenheim Fellowship, received the von Neumann prize of the AMS and SIAM, and delivered the Josiah Willard Gibbs lecture of the American Mathematical Society. He is a SIAM Fellow, a Fellow of the American Academy of Arts and Sciences, and a member of the National Academy of Sciences.

ICIAM LAGRANGE PRIZE: George Papanicolau.

George Papanicolaou has devoted his long and productive career to the analysis and prediction of the many phenomena in the world around us that involve multiple scales and are best viewed as random. The tools he developed include some that are rooted in "pure" analysis and probability theory, combined with asymptotics and computation. Though the specific applications are many and diverse, the body of his work constitutes a coherent and broadly applicable whole.

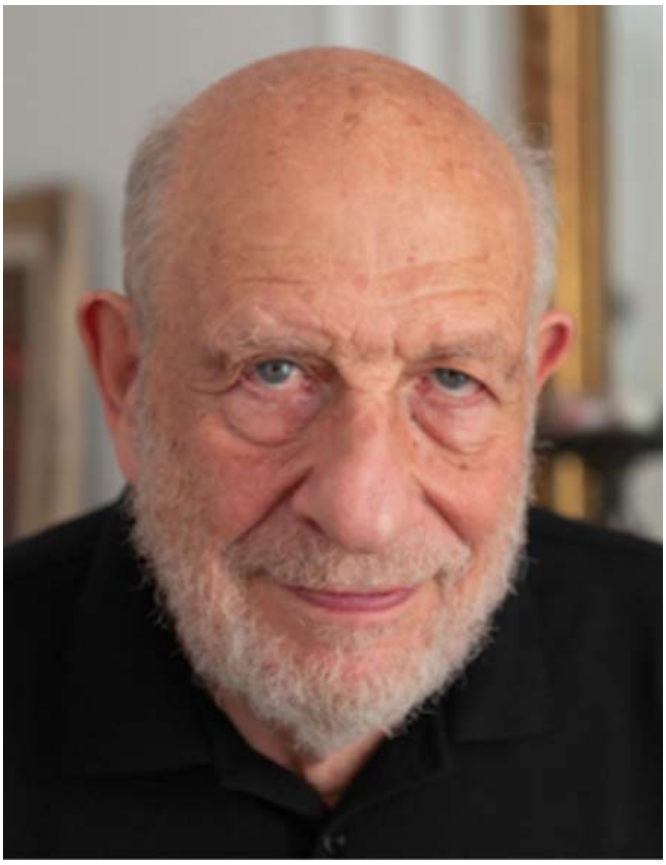
In particular, his work on waves in random media and on the multiscale analysis of stochastic systems culminated in the celebrated book (with Bensoussan and Lions) "Asymptotic Analysis of Periodic Structures" that has had a huge impact on the development of homogenization methods. He performed a remarkable analysis of the universal focusing singularity of the nonlinear Schrödinger equation, and pioneered the mathematical theory of time reversal for waves in random and heterogenous media. He has made important contributions to financial mathematics, in particular to the understanding of volatility and risk assessment. He contributed to the development of imaging methods, such as synthetic aperture radar and passive sensor imaging with ambient noise. He has made important contributions to the analysis of scattering and of diffusion, including turbulent diffusion.

ICIAM MAXWELL PRIZE

Claude Bardos is the winner of the 2019 ICIAM Maxwell Prize, for his seminal contributions to nonlinear partial differential equations, kinetic theory, and mathematical fluid mechanics.

Claude Bardos was born in 1940 in Paris, where he also did his Thèse d'Etat in 1969 at CNRS under the supervision of Jacques-Louis Lions. Since then he held professorships at several places in France but mainly in Paris, where he is now an Emeritus Professor in the Laboratoire Jacques-Louis Lions at Université Paris Denis Diderot (Paris 7).

Claude Bardos has had a huge direct and indirect influence on generations of applied mathematicians through his seminal and inspiring work on hyperbolic partial differential equations, on kinetic equations, on many-particle limits, and on Vlasov equations. Moreover, his deep and profound research in fluid dynamics has advanced our knowledge of the Euler equations of gas dynamics, the Navier-Stokes equation, and of boundary-layer problems.



ICIAM MAXWELL PRIZE: Claude Bardos.

His contributions span the range from nonlinear partial differential equations, control theory, high-frequency asymptotics, to computational methods. His approach shows an excellent taste in turning physical intuition into rigorous mathematical tools. In the early 1990s, in joint work with Golse and Levermore, he used the so-called

velocity-averaging lemma to show that the renormalized solutions of DiPerna and Lions for the Boltzmann equation lead to Leray-Hopf weak solutions of the Navier-Stokes equations. Another example in this spirit is given by his work of the multi-configuration time-dependent Hartree-Fock model, which uncovers deep analytical and geometrical structures that provide a new understanding of quantum mechanics and pave the way to a more efficient numerical treatment of problems in quantum chemistry.

Claude Bardos has shaped the landscape of applied mathematics over the last forty years, improving the qualitative understanding of nonlinear partial differential equations, developing novel and powerful analytical tools, and educating a new generation of mathematicians.

ICIAM PIONEER PRIZE

ICIAM PIONEER PRIZE: Yvon Maday.

Yvon Maday is the winner of the 2019 ICIAM Pioneer Prize, for his leading role in the introduction of powerful methods for numerical simulation, such as spectral methods, reduced order modeling, domain decomposition, models and simulation in medical sciences, fluid-structure interaction, and ab-initio chemistry. Several of his works helped in the launching of start-ups and are intensively used in industry.

Yvon Maday was born in Saint Brieuc (Bretagne/France) in 1957. He graduated at Université Pierre et Marie Curie as a student of École Normale Supérieure de Saint Cloud. He became a Doctor of Mathematical Sciences (thèse d'état) from the Université Pierre et Marie Curie (UPMC) in 1986. After becoming assistant professor at Université of Creteil in 1981, he spent 18 months as a visiting professor at Brown University and MIT before getting a position of full professor at Université Pierre et Marie Curie in 1989. He has also been a visiting professor at the Division of Applied Math at Brown University for 15 years.

Yvon Maday is currently professor at Sorbonne University, Paris (formerly UPMC), and also holds a chair at Brown University, USA. He has held several important responsibilities, including dean of the school of mathematics at UPMC, chair of the Laboratoire Jacques-Louis Lions, and president of the French Applied Mathematical Society (SMAI). At the same time, thanks to his rare energy and talent, he has developed a very substantial and integrated research program on a large variety of topics, such as spectral methods, reduced order modeling, domain decomposition, models and simulation in medical sciences, fluid-structure interaction, and ab-initio chemistry. He has supervised more than 40 PhD students and written more than 180 papers in highly ranked journals, as well as 6 books.

Yvon Maday was an invited lecturer at ICM 2006 in Madrid, he was elected to the European Academy of Sciences in 2003 and appointed as a senior member of the Institut Universitaire de France in 2012. The Jacques-Louis Lions prize was awarded to him by the French Academy of Sciences in 2009.

He has frequent interactions with engineers, chemists and biologists, and with industry. His interests in interdisciplinary and industrial research have led him to build the successful CEMRACS summer schools held every year at the CIRM conference center in Marseille, France. In 2017, he founded the Carnot institute SMILES which aims to promote collaboration between academic and industrial research in the areas of modeling, simulation, optimization and data sciences.

Jointly with Anthony Patera, Yvon Maday introduced and analyzed the Legendre spectral element method, in particular for fluid models such as Stokes and Navier-Stokes. This led to the Nek5000 Navier-Stokes code of Paul Fischer that is widely used to simulate turbulence on massively parallel machines.

In collaboration with Christine Bernardi, Yvon Maday introduced the Mortar element method that has become quite prominent in parallel computing and has been applied extensively in a wide range of disciplines including fluid dynamics, electromagnetism and contact mechanics.

Jointly with Jacques-Louis Lions and Gabriel Turinici, Yvon Maday developed domain decomposition methods in the time variable for evolution problems. These techniques, known as parareal discretizations, result in dramatic gains of CPU time when compared to standard evolution schemes.

Together with Anthony Patera, he developed and analyzed several model order reduction techniques for parametrized problems, in particular the Reduced Basis method, as well as the Reduced Basis Element method that integrates local model order reduction within a general domain decomposition framework. Closely related is the empirical interpolation method (EIM) that aims at treating efficiently general types of parameter dependence

and various nonlinear problems. The EIM method is remarkably original in both formulation and analysis, essentially an interpolation framework tailored to a particular manifold, and has given rise to many related hyperreduction techniques.

The numerical methods developed and analyzed by Yvon Maday have always been driven by their ability to treat concrete applications, which led him naturally to interact with other disciplines. In mathematical medicine, the mortar method was used in the development of numerical fluid-structure coupling for the analysis of blood flow in the heart, and the reduced basis element method was employed in breathing simulation in order to manage the complex geometry of the lung. In quantum chemistry, the domain decomposition methods were used to reduce dramatically the computational time in the simulation of continuum solvation.

ICIAM SU BUCHIN PRIZE

ICIAM SU BUCHIN PRIZE: Giulia di Nunno.

Giulia di Nunno is the winner of the 2019 ICIAM Su Buchin Prize, for her long-lasting record of actively and efficiently encouraging top-level mathematical research and education in developing African countries.

Giulia di Nunno was born in Milano, Italy, in 1973. She graduated with honors at University of Milano in 1998 and got the PhD degree from University of Pavia in 2003. From 2003 to 2010 she occupied various positions at the universities of Oslo and Bergen, and from 2010 she is full professor at the University of Oslo. Between 2014 and 2015 she was Group Leader of the research program SEFE: "Stochastics in Environmental and Financial Economics" at the Centre of Advanced Studies, Norwegian Royal Academy of Science and Letters, and from 2014 to 2017, Group Leader of the Centre of Mathematics for Applications (CMA).

For the past decade, in parallel with an active academic career, Giulia Di Nunno has contributed significantly to the promotion of high level mathematics, particularly in Africa. Di Nunno chairs the Committee for Developing Countries of the European Mathematical Society. She is at the heart of two groundbreaking initiatives encouraging excellence in research and education in the region: the EMS-Simons program of visiting professors and the Emerging Regional Centres of Excellence program.

The African continent is very diverse and the development of a career in mathematics faces a different and sometimes difficult progression. Thanks to Di Nunno's efforts, the Simons Foundation and the European Mathematical Society opened a joint program sponsoring visits to foster research opportunities for young and established researchers. The aims are to help the advancement of individual career possibilities and to improve the global capacity in African academic institutions. The program is open to all areas of pure and applied mathematics and statistics and it is directed to fellows based in Africa.

The Emerging Regional Centres of Excellence is a title of quality awarded to institutes that show an outstanding level in their geographical area of influence in research and education, making them an attractor of students from other regions and countries. The title is granted for a period of four years, and can be renewed. The focus of this program is the education of students to the Master's level and possibly PhD's. Di Nunno coordinated the evaluation and selection procedures for the program's recruitment.

The award salutes Di Nunno's continued and long lasting record efficiently putting in place projects that help shape an intensive development of Mathematics in the African continent.

Subscribing to the ICIAM Newsletter

The ICIAM Newsletter appears quarterly, in electronic form, in January, April, July and October. Issues are posted on the ICIAM website at iciam.org/dianoia. If you would like to be notified by e-mail when a new issue is available, please subscribe to the Newsletter. There is no charge for subscriptions. To subscribe or unsubscribe, visit the website given above.

OPEN CALLS AT ICIAM 2019

CALL FOR CONTRIBUTED PAPERS AND POSTERS

The ICIAM 2019 Organizing Committee is pleased to announce the call for contributed presentations in lecture and poster format in all areas consistent with the conference themes.

Delegates willing to submit a contributed presentation are invited to visit the Submissions & Calls section within the 'For Participants' menu tab at www.iciam2019.com.

Deadlines for submissions:
Contributed papers: January 7th, 2019
Posters: April 1st, 2019

MINISYMPOSIUM PROPOSALS

We recall that Minisymposium proposals may be submitted until November 5th, 2018.

Delegates willing to organize a Minisymposium are invited to visit the Submissions & Calls section within the 'For Participants' menu tab at www.iciam2019.com

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FINANCIAL SUPPORT TO ATTEND ICIAM2019-VALENCIA

The online financial support application form is open.

The financial support program is addressed to researchers of any nationality and professional situation needing financial and travel support to attend the ICIAM 2019 congress.

Delegates willing to apply for financial support are invited to visit the Financial Support section within the 'For Participants' menu tab at www.iciam2019.com.

Deadline for applications: February 25th, 2019

We look forward to seeing you in Valencia!

ICIAM 2019
Organizing & Scientific Committee

ICIAM 2019 Valencia Sign Up

If you want to follow the announcements, news and deadlines concerning the ICIAM 2019 congress, please subscribe here to our Newsletter.

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Letter to the Editor

In response to "Comments on the Bond report" by Barbara Keyfitz in ICIAM Dianoia, Vol. 6, No. 3, July 2018

Wil Schilders, president of EU-MATHS-IN
Eindhoven University of Technology, The Netherlands

Having attended the presentation of the "Bond report" in the House of Lords on April 26, I had a particular interest in the recent article by Barbara Keyfitz. I largely agree with her comments as well as her recommendations. First of all, indeed the report is very specific about the UK situation. This is not bad, we issued several NL-specific reports in my home country in order to convince policy makers and politicians. However, although the UK is an island in the literal sense, it should not be regarded as such in a figurative sense, and neither should any other country, for the simple reason that often the challenges faced are very similar. This was one of the reasons to start EU-MATHS-IN, so as to learn from each other, discuss best practices and exchange successful strategies. Europe has organisations like ECMI, EU-MATHS-IN, in the USA there is SIAM, in Asia there is APCMfI, and on a world-wide scale there is ICIAM. All of these organisations are strong driving forces in exchanging knowledge (in the two-way sense) between mathematicians and industry/society, but none of these are mentioned in the report. EU-MATHS-IN has very active national networks in many European countries, and it would be mutually beneficial if a strong UK network would join.

I also underline Barbara's statement that "greater understanding that the inspiration goes in both directions would be a powerful motivation for engaging in this effort," where the latter refers to the extent to which interaction with another discipline has an impact on research in mathematics itself. Too often I sense that applied mathematics is regarded as literally applying already existing mathematics. For this reason, Michael Guenther (Univ Wuppertal) and I are compiling a book with the working title "Novel mathematics inspired by industrial challenges." There is a lot of interesting research in mathematics, even entirely new fields, sparked by applications. If more mathematicians would realize this, and also experience it is really fun and rewarding, that would be a big step forward. This attitude should be stimulated much more, maybe as an added recommendation to the "Bond report."

Barbara is absolutely right about the silos and recommendation 17 in the "Bond report." This does not happen just by itself overnight, organisations like ICIAM, ECMI, EU-MATHS-IN, SIAM etc. are needed to convince people it is absolutely necessary to make this interaction happen. Funding bodies also require mathematicians to get out of their silos, and work with other disciplines. But other disciplines should also realize the potential of maths, come out of their silos, and take us on board. The latter does not happen a lot, they often forget to add mathematicians. Two years ago, at the European ICT days in Bratislava event, one director of the European Union said literally: "Mathematics is often the missing component in projects." This is not only due to the mathematicians, it is also due to the other silos. We need to convince them it is essential, as well as very beneficial, to take mathematicians on board.

Finally I would like to add to the remarks concerning the studygroups (industrial problems workshops). There is a European COST network termed MI-NET[1] that is successful in promoting these studygroups, organizing them also in countries in Eastern Europe. However, Barbara's question is very valid: what is their effectiveness? We, in the Netherlands, had the same question. For more than 20 years, we are organizing such studygroups on the national level, and it is always fun. However, we also asked the question: what is the effectiveness? Is there any follow-up, or do we say "goodbye" on the final day of the workshop, and part our ways? For this reason, we have appointed a person who is working on the follow-up: she is visiting the companies, discusses their needs, asks what did the workshop bring them, and discusses possible follow-up actions to make things more effective. The "Bond report" could be more specific on this point, by adding a recommendation that further action is needed to make these studygroups much more effective.

Despite the critical notes, reports like the "Bond report" are the way to go forward: in the Netherlands we started the Platform for Mathematics in 2010, wrote a sequence of reports over the years (a vision document[2], a Deloitte report[3] like the one published in the UK, a book with success stories[4], and finally a Deltaplan[5] for Mathematics containing 20 action lines with associated price tags), then founded a Mathematics Council which has now, after several talks at the ministry, achieved that there will be several additional millions of Euro for mathematics research in the next six years. This will enable starting new positions, employ additional PhD students, and executing other action lines from the Deltaplan. The lesson is: we should organize ourselves as mathematicians, on all levels (national and international), and act together. Only then can we be successful.

[1] mi-network.org
[2] www.platformwiskunde.nl/wp-content/uploads/2016/10/Formulas-for-insight-and-innovation.pdf
[3] www.platformwiskunde.nl/wp-content/uploads/2016/10/Deloitte-rapport-20140115-Mathematical-sciences.pdf
[4] www.platformwiskunde.nl/wp-content/uploads/2016/10/PWNsuccesformules_LowRes.pdf (in Dutch)
[5] www.platformwiskunde.nl/wp-content/uploads/2016/10/DeltaplanWiskunde.pdf (in Dutch)

Great Computational Science and Applied Mathematics in Hanoi 2018

by Rolf Jeltsch

Figure 1: Adelina Sequeira of the University of Lisbon.

The series of the *International Conference on High Performance Scientific Computing*, HPSC, was started in 2000 and is held every three years in March in Hanoi. Hence, this time it was the 7th HSPC event. I was invited in 2000 as a plenary speaker and have been on the Scientific Committee ever since. Despite its title it concentrated at the beginning more on numerical analysis, mathematical modeling, and applied mathematics. However with the development of high performance computers the emphasis shifted more and more to HPSC and its subtitle "Modeling, Simulation, and Optimization of Complex Processes." For example this year in a mini-symposium, Jonas Sukys of "Eawag: Swiss Federal Institute for Aquatic Science and Technology Systems Integrated Assessment and Modeling" reported on the development of software and its use for numerical simulation involving up to one trillion mesh elements and 500,000 cores. This is a strong illustration of the efficiency of new methods and machines. In a plenary lecture Adelina Sequeira of the University of Lisbon talked on "Cardiovascular Modeling and Simulations: Applications to Patient-Specific Clinical Studies," see Figure 1. The number of participants has increased over the years from about 200 at the first conference to about 300 this year. Just compare the group pictures from 2000 (Figure 2) and the one of this year (Figure 3). The number of mini-symposia has more than doubled in the same period. For the list of the plenary speakers and the mini-symposia see the link indicated at the end of the article.

One of the intentions of the original conference was to bring the field of applied and computational mathematics to Vietnam and to promote the collaboration between Vietnamese and Western mathematicians. In particular Germany has been and is still a very strong driving force. While at the first HPSC more than 80% of the participants came from Vietnam, in this year's conference one still observes a very high percentage of Vietnamese names but their working places are now often outside Vietnam.

Figure 2: Conference participants in 2000.

Figure 3: Conference participants in 2018.

In general the conference has become much more international; participants came from 28 different countries, the strongest delegations were Vietnam, Germany and USA with 127, 85 and 24 participants. There were delegates (up to five from some countries) from China, Switzerland, Thailand, South Korea, Canada, Italy, Japan, Myanmar, Norway, Serbia, UK, Australia, Cape Verde, Indonesia, Malaysia, Nepal, Poland, Portugal, Russia, Singapore, South Africa, and Taiwan. This list is ordered by the number of participants from each country. ICIAM supported this conference with USD 3,500. These funds were used to support nine participants from Indonesia, Myanmar, Nepal, South Africa, and Thailand.

This year's conference was again a huge success as has been the whole development of the HSPC series.

At this point I have to mention the main organizers, Hoang Xuan Phu from the Institute of Mathematics, Vietnam Academy of Science and Technology, Hanoi and Georg Bock of the Interdisciplinary Center for Scientific Computing (IWR), Heidelberg University, Germany. Another part of the success was the support by the IMU. The secretary general of the IMU from 2007–2014, Martin Grötschel, motivated all Presidents of IMU who do application-oriented work to accept to be plenary speakers: John Ball, László Lovász, and Ingrid Daubechies. His successor in 2015, Helge Holden, gave a lecture in 2015 and attended this years HPSC, too.

Figure 4: Conference secretary Professor Phan Thanh An.

The main organizer, Phu, has fantastic skills. It is due to him and his staff that all eight plenary lectures and 202 contributed talks were presented and only two persons from the list of 305 participants have to be listed as no-shows. In addition to Phu, one has to mention the meticulous and efficient work done by the conference secretary Professor Phan Thanh An (pictured at work in Figure 4) from Hanoi and USP in São Carlos, SP, Brazil, and all the local staff. More in the background, even Phu's wife and their son helped, too. Note that not only were the lectures extremely well organized but so too were the buses which brought you from the hotels to the conference site and back or to some social events. Owing to the increase of participants and number of lectures the venue had to be moved from the Vietnam Academy of Science and Technology to the building of Ta Quang Buu Library on the campus of Hanoi University of Science and Technology with its large lecture hall, where the group photo, Figure 3, was taken.

Last, but not least, let me mention the social program. On Monday evening tradition has it that one goes to a Nguyen Van Duc Snake Restaurant. In the earlier conferences one had the choice between snake or boar, but this time now one could also choose less exotic options. On Tuesday there is always a dinner with traditional music. On Wednesday afternoon there were two options for an excursion. One was what I call 'Halong Bay on land.' This is a trip on small boats on a river between towering limestone pillars like the one in Halong Bay. Sometimes the river just has created tunnels through these rocks. The conference dinner was on Thursday with traditional dancing and music. Participants had to choose on a website not only which social event they wanted to attend but also which meals they would prefer. Collection of participants at the airport was organized. A visa to be picked up on arrival could be ordered directly on the internet. Of course Hanoi offers also many things to see and to do. Some attended the post conference tour on Halong Bay, some partners took some cooking lessons, and more.

Note that the next conference will be in March 2021. The whole information on this year's conference can be found on the webpage hpsc.iwr.uni-heidelberg.de/HPSCHanoi2018.

To see how it was at earlier conferences just replace in the above link 2018 by the corresponding year of the event. Note that during all these conferences Xuân Son was the main photographer.

Hoang Xuan Phu is a professor at the Institute of Mathematics, Vietnam Academy of Science and Technology. He did research in Optimization and Optimal Control, Functional Analysis, Numerical Analysis, with applications as inventory problems, control of hydro-electric power plants and reservoirs, robotics, fluid mechanics, etc. He is a corresponding member of the Heidelberg Academy of Sciences and Humanities and of the Bavarian Academy of Sciences and Humanities, and a fellow of TWAS (The World Academy of Sciences — for the advancement of science in developing countries).

Rolf Jeltsch is a retired professor from ETH Zürich. He did research in Numerical Analysis, from theoretical investigations to engineering applications, parallel computing, computational sciences. He was the President of the SMG (Swiss Mathematical Society), EMS (European Mathematical Society), GAMM (International Association of Applied Mathematics and Mechanis) and ICIAM. In addition he was the Director of the congress ICIAM 2007 held in Zürich. He has received three honorary degrees of which one is from the of the Vietnamese Academy of Science and Technology.

Tosio Kato as an Applied Mathematician: A Historical Study of a Japanese Mathematician

Introduction

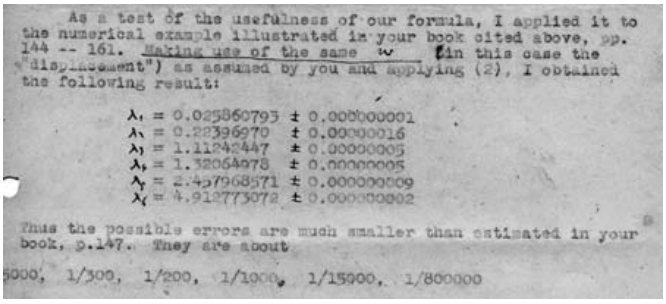
Tosio Kato (1917–1999) is considered to be a rigorous analyst or theorist. Many people consider his contributions in quantum mechanics to be epoch-making, his work on nonlinear partial differential equations elegant and inspiring. However, around the time when he visited USA for the first time in 1954, he was studying problems of applied mathematics, too, notably numerical computation of eigenvalues. The present authors, who are deeply indebted to his guidance, hope to shed light on the historical background of his study of applied mathematics.

Kato as a Physicist

Kato is remembered primarily as a pure analyst and his exactitude is still admired by many, and the reader may wonder why applied mathematics mattered to him. But this is no wonder if we see his background. He was trained in the Department of Physics, The Imperial University of Tokyo, and numerical computation of eigenvalues was of utmost importance to him. In his paper "On the Upper and Lower Bounds of Eigenvalues," (J. Phys. Soc. Japan. **4**, (1949), 334–339) he showed his brilliance as a problem solver and his deep insight into the usefulness of a certain inequality which is now called the Kato-Temple (or Temple-Kato) inequality. In our view, its importance is not measured by the numbers of direct citations. Rather, it should be measured by the long period of actual citations. In 2016 and 2017, nearly 70 years after publication, it was cited six times. In view of the rapidness of progress of numerical analysis and computers, this long life of a rather short paper is really outstanding.

Now, note that his famous paper "Fundamental properties of Hamiltonian operators of Schrödinger type," (Trans. Amer. Math. Soc., (1951)) had not been published yet at that time. Namely, the international academic community had not yet heard of this young mathematician, who was working in a physics department in a war-devastated country of East Asia. In order to seek international recognition, he took the often-used tactic: to write a letter to one of the authorities who might well understand the paper's value. His choice was R. V. Southwell, who had authored in 1940 "Relaxation Methods in Engineering Science: A Treatise on Approximate Computation." Southwell was then a professor at Oxford University and his book seems to have been influential. Indeed we found a copy of his book in a storage room of the Library in Physics Department of University of Tokyo. Kato somehow came across this copy and examined the test problem in eigenvalue computation of a certain 6-by-6 matrix. He applied his method to the same data as Southwell used in the book to find that his inequality yielded much more accurate upper and lower bounds than those Southwell obtained. We can imagine his euphoria that his method beat this authority's result on a great scale. He wrote a letter to Southwell and reported his finding on the 16th October, 1949. A reply mail from Southwell is dated the 9th December in the same year: thus it was rather quick. Southwell was quite positive, saying "There would seem with no doubt that you have discovered a theorem which is both novel and important."

Generalization and applications of Kato's idea followed as can be verified in the literature (Math. Ann. (1953), Y. Nakata & H. Fujita, J. Phys. Soc. Japan (1955), K. Washizu, Quar. J. Mech. Appl. Math. (1955), T. Kato & H. Fujita, J. Phys. Soc. Japan (1958), and Kato-Fujita-Nakata-Newman, J. Research NBS, (1957)). His idea can be applied to what is called the numerical verification method (interval analysis), which is now very popular among mathematicians and engineers in Japan (and in other countries).


As a test of the usefulness of our formula, I applied it to the numerical example illustrated in your book cited above, pp. 144 -- 161. Making use of the same w (in this case the "displacement") as assumed by you and applying (2), I obtained the following result:

$\lambda_1 = 0.025860795 \pm 0.000000001$
$\lambda_2 = 0.22396970 \pm 0.00000016$
$\lambda_3 = 1.11242447 \pm 0.00000005$
$\lambda_4 = 1.32064978 \pm 0.00000005$
$\lambda_5 = 2.49?968571 \pm 0.000000009$
$\lambda_6 = 4.912773072 \pm 0.000000002$

Thus the possible errors are much smaller than estimated in your book, p.147. They are about

5000, 1/300, 1/200, 1/1000, 1/15000, 1/800000

A part of Kato's letter to Southwell showing accuracy. Dated 16th October, 1949.

Kato visits the USA

Kato's contributions to numerical computation were then recognized by John Todd — a figure prominent in numerical analysis who was working at that time in the Applied Mathematics Division of National Bureau of Standards (NBS). In early 1953 Kato received a letter from Todd which invited Kato to work with the people of NBS. News of the invitation, which Kato accepted after a few months, was somehow transmitted to Morris Kline of New York University, who wrote a letter to Kato to invite him to stay with him in New York, too. After overcoming visa and financial issues, Kato finally sailed for USA on the 15th September, 1954. The trip continued until 3rd January, 1956. During his stay, Kato seems to have made

many friends in the USA. The picture below was found recently from a Kodachrome, in whose paper frame we can see "Skyline Drive, October, 1955." The photographer must have been Mizue-Kato's wife.

John Todd, Olga Taussky Todd, Lothar Collatz, and Tosio Kato (from left to right). See Barbara Keyfitz, ICIAM Dianoia vol. 1 no. 3, (2013).

The host in New York was Morris Kline, who later become a prolific writer on the history of mathematics and published many books on popular mathematics and mathematics education. His letters to Kato show that he and his group in New York University were interested in Kato's theory on the variational method and eigenvalue approximation, rather than Kato's theory on quantum mechanics.

Kato and the Kline family in November, 1955.

After having come back home, he wrote some papers on matrix analysis, in which we can see the strong influence of Olga Taussky Todd. The only paper which Kato co-authored with Olga Taussky is "Commutators of A and A^*," published in J. Washington Acad. Sci. vol. 46 (1956), 38–40, which shows the typical beauty of Kato's proof technique.

Kato published in his later years a large number of papers on scattering theory, the Korteweg-deVries equation, and the Euler/Navier-Stokes equations, some of which are quite "applied." Due to page limitations, we think we should stop here and would like to discuss these matters in future.

Final Remarks

Tosio Kato was a mathematical perfectionist and (most erroneously) considered to be a pure analyst. However, his sharp brain also penetrated into practical numerical methods. He himself used computers for numerical purposes only in limited occasions. Only hand-driven mechanical calculators (or a motor-driven one if you were lucky enough) were available to his school in the early 1950s. However, during his stay in USA he saw the electronic computers being developed, and recognized their enormous power. After coming back home, he encouraged his pupils to carry out numerical computations and develop numerical methods such as finite difference methods intended for the use of electronic computers. His enthusiasm was carried over to his academic grandchildren & great grandchildren. We believe that he would have been very happy to hear the news that Japan will host the ICIAM in 2023.

Acknowledgements: It is our great pleasure to express our gratitude to Makio Ishiguro and Shige Toshi Kuroda for their kind permission to use Kato's notes, letters, and photos. We very much thank Barbara Keyfitz for her invitation to write for ICIAM Dianoia and her advice. We are also grateful to Walter Strauss for his valuable comments.

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Hisashi Okamoto defended his doctoral thesis under the guidance of Hiroshi Fujita at the University of Tokyo, worked in Kyoto University for 27 years, and is currently a professor of mathematics in Gakushuin University, Japan. He is a member of SIAM & the Mathematical Society of Japan and he is a fellow of Japan SIAM & Japan Society of Fluid Mechanics.

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