NEWSLETTER

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Awards & Achievements

Academic Ranking of the Department

According to the latest release of the Academic Ranking of World Universities (ARWU), the ranking consultancy administered by Shanghai Jiao Tong University, our Department ranked in the top 100 in mathematics over the World. ARWU uses five indicators to rank mathematics departments, namely, the number of alumni who had been awarded the Fields Medal after 1951, the number of staff who had been awarded the Fields Medal after 1961, the number of highly cited researchers in mathematics, the number of papers in Science Citation Index in the mathematics field and the percentage of papers published in the top 20% mathematical journals to that in all mathematics journals. PolyU Mathematics is No. 3 in China behind Peking University and CUHK and No. 8 in Asia. While the list does not list AMA's exact ranking, it is our estimate that we are ranked between No. 85 – 88. The top six mathematics departments in the ARWU list are Princeton, Berkeley, Harvard, Stanford, Cambridge and University of Paris Sud.

Academic Ranking of World Universities in Mathematics - 2009

Methodology | Statistics

World Rank	Institution*	Country	Score on HiCi	Score on PUB	Score on TOP
1	Princeton University	🇺🇸	76	65	93
2	University of California, Berkeley	🇺🇸	94	76	86
3	Harvard University	🇺🇸	82	60	91
4	Stanford University	🇺🇸	100	65	97
5	University of Cambridge	🇬🇧	52	50	76
6	University of Paris Sud (Paris 11)	🇫🇷	37	69	78
...	...	...	...	...	...
76-101	The Hong Kong Polytechnic University	★	37	38	65
...	...	...	...	...	...

To facilitate learning through excellent teaching and research, leading expertise in optimization, optimal control, applied statistics and actuarial science, financial mathematics and engineering mathematics

PolyU Education Info Day 2009

PolyU Education Info Day is the most important annual promotional activity of the University. It aims at helping prospective students make appropriate choice of study programmes. This year, the event was conducted successfully on Saturday 26 September and attracted around 28,000 visitors.

AMA's exhibition booth was located at FG Wing. Staff members and student helpers in uniforms prepared by Faculty of Applied Science and Textiles presented the Department in a very positive light. Detailed information about AMA programmes, research achievements, teaching & learning activities were disseminated to visitors via display boards, posters and promotional material. Visitors were attracted by our eye-catching game booth and tailor-made souvenirs. They participated in the "Diamond Game" by first answering a probability question followed by a more challenging problem in probability. Those who got the correct answers were awarded prizes. Other activities included a forum entitled "Parents' Corner" organized by SAO, a demonstration session on the Bloomberg Financial Information System and three Info Seminars bearing the title "What has it got to do with Mathematics?". The Info Seminars attracted about 400 students, some of them had to sit on the steps of the lecture theatre.

All in all, the Info Day was conducted successfully and once again staff and students have shown their great team spirit in the organization of the event.

School Talks

The 3-year UGC-funded BSc (Hons) in Investment Science Programme was launched successfully in September. To strengthen the awareness of our Programme in our prospective students, five school talks were organized for students of secondary schools and associate degrees providers, including Pui Ching Middle School (培正中學), Tang King Po School (鄧鏡波學校), TWGH SC Gaw Memorial College (東華三院吳祥川紀念中學), PolyU Hong Kong Community College and HKU Space Community College. The 45-minute talk gave students detailed information about the

Investment Science Programme, admission qualifications, career prospects and student development aspects through video displays from our teaching staff and from professionals in the Industry. During the Q & A sessions, students were keen to know about our Department and its programmes. These activities helped the Department to further its working relationship with career teachers and school administrations.

Distinguished Alumni Lectures

The Department organized Distinguished Alumni Lectures and a Reunion Dinner on Saturday 20 June 2009 at PolyU. We were happy to invite two distinguished alumni to deliver lectures to our students. They were Dr. Victor Lo (Vice President, Fidelity Investments) who delivered a lecture entitled "Driving Business with Cutting-Edge Analytics in the Real World" and Mr. Lawrence Li (Director, Compasseco Enterprises Co. Ltd.) who gave a lecture on "The Power of Awareness". Students had an opportunity to talk to a number of alumni and to learn from their valuable experience in career development. They also enjoyed speaking to alumni about their PolyU life in the distant past. Although the activity was organized during the H1N1 outbreak, this did not lessen the enthusiasm of our students and alumni. Over 60 of them participated in the event.

Dr. Victor Lo receiving a souvenir from Prof. Qi

*Dr. Cedric Yiu with a group of students at the Dinner*

Mr. Lawrence Li talking to the audience

Workshop on Approximation and Optimization on the Sphere and Other Surfaces

A workshop entitled "Approximation and Optimization on the Sphere and Other Surfaces" was held on Saturday 24 October 2009 at PolyU. Many challenging problems in mathematics and scientific computation were posed. The Workshop allowed research leaders in the area to exchange ideas and enhance collaboration. The ten invited speakers were: Raymond Chan and Ka Shing Lau from CUHK, Tony Chan from UST, Xiaojun Chen, Ian Sloan, Rob Womersley and Liqun Qi from PolyU, Franklin Luk and Michael Ng from HKBU and Stephen Smale from CityU. The Workshop was attended by some 50 participants.
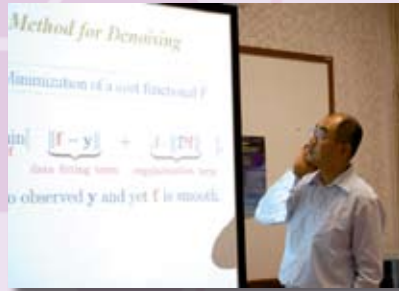
Prof. Raymond Chan (CUHK) delivered a talk on "Simultaneously Inpainting in Image and Transformed Domains"

Prof. Tony Chan (HKUST) gave a talk on "Brain Mapping with Conformal and Quasi-conformal Geometry"

Workshop on Financial Mathematics and Applied Statistics

The Department organized a workshop entitled "Financial Mathematics and Applied Statistics" on Saturday 5 December 2009. The Workshop provided an opportunity for some 40 researchers to become acquainted with current research problems in these areas. The eleven invited speakers were: Shige Peng from PolyU, Lixing Zhu from BUHK, Nicolas Privault and Qiang Zhang from CityU, Ngai Hang Chan and Duan Li from CUHK, Wai Keung Li and Hai Liang Yang from HKU, Rob Womersley and Phillip Yam from PolyU, and Qi Man Shao from UST.

The Origins of Soliton Theory : A Short History

The onset of the Industrial Revolution in the mid 18th Century in Britain saw the construction of an extensive network of canals to connect centres of production and their markets. These canals, designed for the purpose of commerce proved, by serendipity, to be natural laboratories for the observation of certain novel hydrodynamic waves. By the early part of the 19th Century, the basic mathematical underpinnings of hydrodynamics had already been established by such luminaries as Leonard Euler and Joseph Louis Lagrange. Indeed, the latter had analysed the propagation of small waves on shallow water by means of his new theory of hydrodynamics. However, it was not until a chance happening on a canal in 1834 that the study of the motion of large water waves was initiated.

Thus, in August 1834, a Scottish engineer and naval architect called John Scott Russell was riding his horse alongside the Union Canal near Edinburgh when he observed a remarkable phenomenon which was to have far-reaching scientific consequences that extend to the present day. Russell later recalled the circumstances of his discovery.

"I was observing the motion of a boat which was rapidly drawn along a narrow channel by a pair of horses when the boat suddenly stopped — not so the mass of water in the channel which it had set in motion: it accumulated round the prow of the vessel in a state of violent agitation, then suddenly leaving it behind, rolled forward with great velocity, assuming the form of a solitary elevation, a rounded smooth and well-defined heap of water, which continued its course along the canal apparently *without change of form or diminution of speed*."

Russell later reproduced this solitary wave in a rectangular tank. Importantly, beyond a certain threshold, the disturbance was accommodated in not one, but two solitary waves which progress as separated humps along the channel. This two-wave phenomenon is evident in Russell's report to the British Association, published in 1845. Russell had earlier recorded that the speed of the individual solitary waves is proportional to their height. A consequence of this is that a higher wave starting behind a smaller, must eventually catch it up resulting in mutual interaction. However,

regrettably, the length of the channel in Russell's experiments was too short to allow the remarkable nature of the nonlinear interaction of these large amplitude waves to be observed.

The importance of Russell's observations concerning his '*Great Wave of Translation*' were early called in question-notably by Sir George Airy — the Astronomer Royal. There ensued a controversy which was to involve some of the most eminent men of Victorian science — in the main arrayed against Russell. The matter was not finally to be resolved in Russell's favour until 1876 when Lord Rayleigh validated mathematically the shape of Russell's solitary wave in a paper published in the Philosophical Magazine. However,

A Pseudo-Spherical Surface (Interior)
Generated by a BT (Exterior)
[C. Rogers & W.K. Schief, Bäcklund and Darboux Transformations.
Geometry and Modern Applications in Soliton Theory.
Cambridge Texts in Applied Mathematics, Cambridge University Press, (2002)]

this work was not well-known and the controversy only ended with the publication in 1895 of a paper by two Dutch scientists, Korteweg and de Vries on the propagation of long waves advancing in a rectangular channel. Therein, a mathematical model encapsulated in the now celebrated Korteweg-de Vries (KdV) equation was introduced which describes the wave propagation in a canal in a manner consistent with the solitary wave observations of Russell in 1834. However, it was not until some 130 years later that a computational study in 1965 by Zabusky and Kruskal at Princeton on aspects of the celebrated Fermi-pasta-Ulam problem led to their recording of the remarkable interaction properties of what they were to term solitons. Thus, Zabusky and Kruskal, in an inspired interpretation of computer output, detected in the KdV model, recurrence phenomena which we now associate with soliton survival following interaction. Their analysis was, however, necessarily numerical since the mathematical methods which would allow the analytic treatment of nonlinear soliton interaction in the KdV equation were at that time unknown. These methods, remarkably turn out to have their origin in the work of geometers of the 19th Century on invariance properties of privileged surfaces. The seminal result was due to Bianchi and Bäcklund which provides an iteractive procedure for the construction of a chain of pseudospherical surfaces from a known seed surface.

It was the work of a physicist Seeger and his colleagues in Germany in 1953 that originally demonstrated that the classical Bäcklund transformation (BT) and its associated nonlinear superposition principle had important application in the analysis of crystal dislocations. The typical solitonic features to be subsequently discovered numerically by Zabusky and
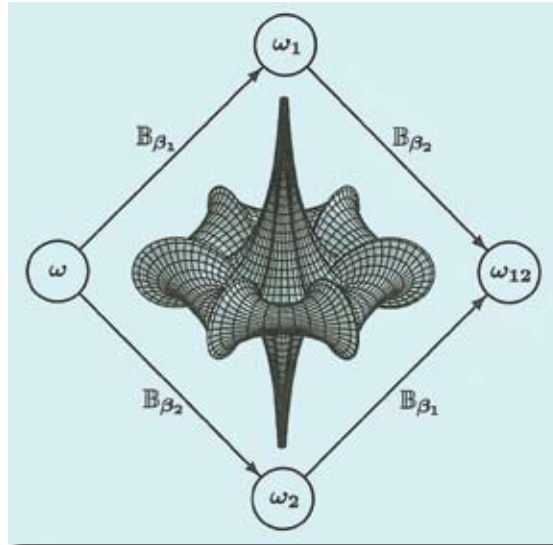
Kruskal in 1965 for the KdV equation, namely preservation of velocity of shape following interaction were all recorded for the sine Gordon model of crystal dislocation theory. However, their work remains little known even to this day.

The Bäcklund transformation for the KdV equation and its associated nonlinear superposition principle were constructed in 1973 by two relativists at the Jet Propulsion Laboratories in the USA. The third key soliton equation, namely the nonlinear Schrödinger (NLS) equation was first derived in nonlinear optics in 1965 although its origins go back to hydrodynamic studies of vortex evolution undertaken at the turn of the 20th Century. In 1974, the Bäcklund transformation for the NLS equation was discovered.

The power of Bäcklund transformations comes through their associated nonlinear principles (permutability theorems). These allow the analytic description of the evolution and complex nonlinear interaction of multi-soliton pulses. This was early demonstrated by Lamb at United Aircraft who in 1975 used the nonlinear superposition principle for the sine Gordon equation to successfully predict the nature of solitonic decomposition of pulses in ruby lasers in accordance with observed experimental results.

By the early 1970s, the three canonical soliton equations namely the KdV, sine Gordon and NLS equations, together with their associated Bäcklund transformations and nonlinear superposition principles were in place. In the same period, the celebrated Inverse Scattering Transform (IST) was developed for solitonic equations. The IST represents a natural extension of the classical Fourier Transform and again can be said to have its origin in classical geometry in work of Gauss.

Thus, by 1974 the skeletal theoretical structure of Soliton Theory was established. The scene was set for an explosion of research activity that continues to the present day. The applications abound. These range from Einstein's theory of relativity and the generation of mathematical representations of black holes to the modelling of energy propagation along protein molecules in biological DNA structures and the design of superconducting devices based on work of Josephson (Nobel Prize 1973).

[The above is an abbreviated and updated version of an address given by Professor Colin Rogers on his election to the Australian Academy of Science (1999)]

Students Corner

ICAC Talk for Final Year Investment Science Students

In the afternoon of 22 October 2009, more than 30 final year Investment Science students attended a talk by Miss Ester Poon Mei-po, Officer from ICAC Community Relations Department of Kowloon West District. During the 1-hour talk, Miss Poon introduced Hong Kong's anti-corruption legislation and common corruption practices in the workplace. The importance of work ethics was impressed upon our students. Miss Poon also showed an interesting video clip and some real-life corruption cases in the banking sector. She also briefed our students about ICAC's recruitment programme and career development. The talk enhanced our students' awareness of personal ethics, and informed them about aspects of corruption and its prevention.

Visit to Securities & Futures Commission

In the morning of 16 November 2009, 41 Investment Science students visited the Securities & Futures Commission (SFC) at Central for a seminar on "Overview of SFC". The seminar was conducted by Mr. Joseph Lee, Senior Manager of SFC External Relations. During the seminar, Mr. Lee introduced the role of SFC, its organizational structure, regulatory role and operations. Apart from the informative presentation, educational videos were shown on healthy investment modes.

Dr. Joseph Lee presented a souvenir to Mr. Joseph Lee, Senior Manager of SFC External Relations

Perhaps one of the most salutary video clips for students was the winning video of "Investment Story Competition 2009", which portrayed an undergraduate student who sought to make quick gains from the stock market. He placed his government tuition loan on a single stock with serious financial consequences.

At the end of the seminar, students raised several questions about the career opportunities and development at SFC. Mr. Lee stated that, although the majority of the SFC staff are experienced legal executives and lawyers, it hires new graduates from various disciplines. SFC Human Resources Department also visits local universities for talks and recruitment events.

Students raised questions on the career opportunities and development at SFC

The visit lasted for almost 2 hours from 11:00 to 12:50. Students had an enjoyable morning and gained improved understanding of SFC and received sound advice on wise investment.

Departmental Group Photo

A Departmental Group Photo for all academic, research and supporting staff was taken before the beginning of the 2009-2010 academic year.


Departmental Christmas Party 2009

The Department will hold its annual Christmas luncheon on 24 December 2009 at the Harbour Plaza Metropolis Hotel. Apart from AMA staff, guests including a number of Faculty Deans, friends and retired colleagues are invited to join the party.

Staff Movement

1. SZE Nung Sing Raymond joined the Department as a Lecturer in September 2009. Raymond obtained his BSc, MPhil and PhD in 2000, 2002 and 2005 respectively, all from the University of Hong Kong. He was a Visiting Scholar in Auburn University in the Fall Semester of 2006 and a Postdoctoral Fellow in the University of Connecticut from 2006 – 2009. His research interests include Matrix and Operator Theory, Quantum Computing and Quantum Information.

2. ZHANG Haiyu Doris was appointed a Tutor in the Department in October. Doris got her PhD from the City University of Hong Kong earlier this year. Her areas of interest include Special Functions, Asymptotic Expansions and ODEs.

3. LI Mang Wan Shermie was appointed Assistant Officer in the Department in November. She was a graduate from PolyU's Department of Chinese and Bilingual Studies. Before joining PolyU, she worked at the Hong Kong Community College as an Assistant Administrative Officer.

4. Rob WOMERSLEY of the School of Mathematics and Statistics, University of New South Wales, was appointed Visiting Professor of the Department from September 2008 to January 2009. Rob got his Bachelor Degree from the
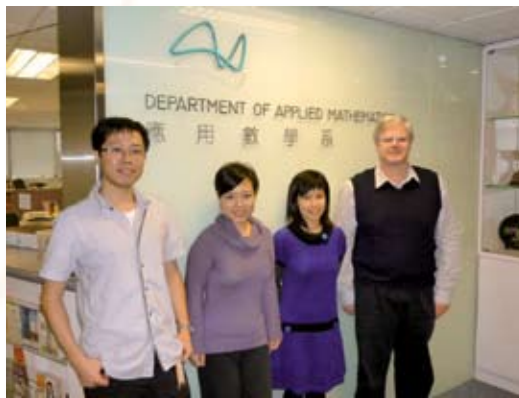
From the left: Dr. Sze Nung Sing Raymond, Dr. Zhang Haiyu Doris, Ms. Li Mang Wan Shermie and Prof. Rob Womersley

University of Adelaide and his MSc and PhD from University of Dundee in 1977 and 1981 respectively. Since then, he has taken up various teaching and research positions at University of Kentucky, Australian National University and University of NSW. His special fields of interest include Computational Methods in Optimization and Mathematics Finance.

5. Francis Austin was promoted to Instructor in September 2009. Our congratulations to Francis on his promotion.

6. OR Ming Keung Benjamin resigned from the Department in August to join the Hong Kong Observatory as a Scientific Officer, and SO Moon Tong Ernest left the Department in December to take up the position of Research Officer in the Hong Kong Police Force. We convey our best wishes to both of them in their new careers.

7. Katie Cheung and Elaine Ching of the General Office left the Department in October and November respectively. Katie joined PolyU's Department of Computing as an Executive Officer, while Elaine was appointed Senior Administrative Assistant at the University's Management and Executive Development Centre.

Alumni News

▌ Update AMA Alumni Database

Support from our alumni is essential for the development of the Department. We urge alumni to access and update our Departmental Alumni Database via *http://www.polyu.edu.hk/ama/alumninfo* so that we will be able to keep you abreast of the latest departmental news and actively involve you in our future activities such as re-union gatherings and surveys.

Upcoming Events

▌ Distinguished Lecture Series

The AMSS-PolyU Joint Research Institute has been organizing the Distinguished Lecture Series conducted by renowned scholars since its inception in 2006. The objective of the Series is to offer a platform for the exchange of ideas and provide first-hand accounts of the speakers' scholarly accomplishments in Engineering and Management Mathematics. We are pleased to announce the following Distinguished Lectures to be held in this semester:

15 December 2009   3:00 pm – 4:30 pm

Speaker	**Professor Chi-Wang Shu**, Brown University, U.S.A.
Title	High Order Methods for Convection Dominated PDEs – An Overview
Venue	AG710

16 December 2009   3:00 pm – 4:30 pm

Speaker	**Professor C.F. Jeff Wu**, Georgia Institute of Technology, U.S.A.
Title	Statistical Work in Nanomaterial Research
Venue	AG710

Editorial Board