

50 YEARS OF MATHEMATICS AND ITS APPLICATIONS

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Readers of *Science in Parliament* have seen on the front cover of the Spring issue that the Institute of Mathematics and its Applications (IMA) is 50 this year. The IMA is celebrating this milestone with a series of events in 2014. We were honoured to welcome our Royal Patron for this anniversary year, Her Royal Highness The Princess Royal, to The Royal Society on 14 May, where we held lectures celebrating the many important facets of mathematics that the IMA, and its members, represent.

... highlighting how the maths developed ...

The IMA was created to provide a home for professional mathematicians. The celebration reflected this with talks covering research mathematics, mathematics in teaching, mathematics in industry and maths for all. The importance of mathematics in all these areas was emphasised throughout, with all the talks highlighting how the maths developed in one area impacts on another seemingly unrelated area.

The day began with 'A Toy Model for a Magnetic Toy: from atomistic to continuum' by Professor Alain Goriely, University of Oxford, who used videos and physical demonstrations to show that the behaviour of 'ball-bearing magnets' can be very similar to elastic materials. One example was a circle of magnetic balls which could be compressed

(like a bicycle tyre) and would then snap back to the original circular shape. There were two things to take away from Alain's talk. The first is that these magnets are great toys that can be assembled into some amazing shapes for use in maths outreach – see dotpedia.com for examples. The second is that current applied mathematics research on the topic, which investigates how the behaviour of the atomistic (discrete) magnets is similar to the behaviour of elastic (continuous) materials, and the

well-known mathematics of elastic materials can be used to model the behaviour of the magnets. It is of course a lot more complicated than that and more details can be found in Alain's article¹.

IMA President, Professor Dame Celia Hoyles DBE, spoke about '50 Years of Maths in Education'. She began towards the beginning of her career. She attended the second International Congress on Mathematics Education (ICME) in 1972, where there was a Turtle Workshop by the MIT Logo group. Revolutionary at the time, this early programming language aimed to teach children about mathematics by getting them to write programs. Although the opportunities for this have significantly increased, programming is still alien to many people. It is important that

children are taught programming and know that this is an important skill (alongside art) for the digital arts. Most people don't know you can't make a modern animation without mathematics! The IMA seeks to make this information available (without the need to understand the maths in detail) with its Mathematics Matters series of case studies².

'50 Years of Maths in Industry' by Iain Gray (Technology Strategy Board) continued the theme of mathematics hidden from the general public, and



Iain Gray (TSB) emphasised the importance of maths in industry.

more importantly from the very businesses that stand to gain most from using industrial mathematics.

... teach children about mathematics ...

Iain gave a fictitious example of a day in the life of 'Isaac', an ordinary man who doesn't see the maths on which his daily life depends. Isaac used the mathematics in his morning coffee, online purchase, vacuum cleaner, Grand Prix viewing, glucose test for diabetes,

without realising he had used any maths at all. Iain gave details for each example. I will give only the first – coffee. Coffee bean growers in Rwanda are being aided by an app that provides localised weather and farming recommendations³.

Maths is hidden but essential to the UK economy. To learn more about the power of mathematics read the IMA's 50th anniversary book, *50 Visions of Mathematics*, which contains 50 maths images and 50 essays on everything from Arbers to Zebras. The book can be ordered on the OUP website⁴.

One amazing piece of mathematics that we now all use is public key cryptography, which uses number theory – an area of core mathematics developed without any application in mind. The IMA Gold Medal Lecture, '(Almost) 50 Years of Public Key Cryptography', by Dr Clifford Cocks CB, began by explaining that public key cryptography is not yet 50 years old. The original research was done by

Cliff Cocks and colleagues at GCHQ in the late 1960s and early 1970s. It was then secret, but is now everywhere – in chip and pin cards, mobile phone calls, remote car keys, and on the internet for secure transactions, which all use this extraordinarily powerful technique.

The President welcomed The Princess Royal, expressed warm thanks to her for agreeing to be our Patron in our anniversary year and for graciously agreeing to come to our event. She then introduced Professor Ian Stewart (University of Warwick) whose talk, 'Mathematics for the Billion' focused on the mathematics that is used by everyone. There are two ways maths is used by everyone. The first is the basic



Professor Ian Stewart told us about the maths used by everyone.

arithmetic we all use when we go shopping, for example. The second is far more interesting – it is the maths used by Iain Gray's 'Isaac'.

... we now all use public key cryptography ...

Ian Stewart gave an example of mathematics that has been both research and school maths. Trigonometry was first research mathematics used in Babylonian and Greek times to calculate distances between planets. More recently trigonometry has been the school maths we are all familiar with for calculating the height of trees or mountains. The same mathematics is used to compress images (jpegs) and more recently for fingerprint compression by the FBI (using Daubechies wavelets).

After the talk Dame Celia thanked Professor Stewart and invited The Princess Royal to speak to the IMA guests. As Her



HRH The Princess Royal presents IMA MathsCareers certificate to poster competition winner, Miss Laura Guyll.

Royal Highness mentioned, she is not the first member of The Royal Family to be involved with the IMA; HRH The Duke of Edinburgh was President of the IMA from 1976–1977.

Many of the IMA's activities were mentioned in glowing terms, including conferences, journals, books, promoting careers, employers' forums, MathsCareers, Mathematics Matters, Maths Teacher Scholars, CMATH (which is incorporated by Royal Charter and provides a benchmark for professional mathematicians similar to CEng). The Princess Royal stressed the importance of maths teaching to ensure we have enough people in the future.

Her Royal Highness finished by saying that investing in the next generation certainly pays, before announcing her presentation of the certificate to the IMA

MathsCareers 11–13 Competition Winner, Miss Laura Guyll, who she had no doubt is one of nature's natural mathematicians and will continue to be so.

The IMA then made two presentations to The Princess Royal in commemoration of her Patronage of the IMA in its 50th anniversary year. Dame Celia presented her with an Honorary Fellowship Certificate, and Chris Budd presented her with a copy

of the IMA's 50th anniversary book, *50 Visions of Mathematics*.

the inbuilt error detection in the bar code⁵. The IMA's 50th anniversary programme continues with a Festival of Mathematics 3–4 July in Manchester, and concludes with a talk on 'Eight Great Reasons to do Maths' by the IMA Vice-President of Communications, Professor Chris Budd at the Royal Institution in October.

... The Princess Royal stressed the importance of maths teaching ...

The day concluded with a comedy routine from stand-up mathematician Matt Parker (QMUL). My favourite part of the show was a trick with barcodes. Given the first 12 digits of a barcode, Matt calculated the final digit using

of the IMA's 50th anniversary book, *50 Visions of Mathematics*.

References

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