Annual Report to Members 2019

Institute *of* mathematics & its applications

Glossary

ACME — *Advisory Committee on Mathematics Education*
AR — *Academic Representative(s)*
BAMC — *British Applied Mathematics Colloquium*
BEIS — *Department for Business, Energy and Industrial Strategy*
CMath — *Chartered Mathematician*
CMS — *Council for the Mathematical Sciences*
DfE — *Department for Education*
ECM — *Early Career Mathematicians*
EdMS — *Edinburgh Mathematical Society*
EPSRC — *Engineering and Physical Sciences Research Council*
EuMS — *European Mathematical Society*
FAcSS – *Fellow of the British Academy of Social Sciences*
FBA – *Fellow of the British Academy*
FE — *Further Education*
FRSE – *Fellow of the Royal Society of Edinburgh*
FTE — *Full Time Equivalent*
GCE – *General Certificate of Education*
GCSE – *General Certificate of Secondary Education*
HE – *Higher Education*
HEdSA — *Higher Education Services Area*
HEI — *Higher Education Institutions*
HoDoMS — *Heads of Departments of Mathematical Sciences*
ICIAM – *International Council for Industrial and Applied Mathematics*
IF – *Impact Factor*
IMA — *Institute of Mathematics and its Applications*
InFOMM —*Industrially Focused Mathematical Modelling*
ITT – *Initial Teacher Training*
JMC — *Joint Mathematical Council of the United Kingdom*
KS3 – *Key Stage 3*
LMS — *London Mathematical Society*
MA — *The Mathematical Association*
MEI — *Mathematics in Education and Industry*
NANAMIC — *National Association of Numeracy and Mathematics in Colleges*
NCETM — *National Centre for Excellence in the Teaching of Mathematics*
ORS — *Operational Research Society*
OU – *Open University*
PAC – *Professional Affairs Committee*
RSS – *Royal Statistical Society*
S&FE — *Schools and Further Education*
SET — *Science, Engineering and Technology*
SIAM — *Society for Industrial and Applied Mathematics*
SIAM UKIE — *UK and Republic of Ireland Section of SIAM*
SORP – *Statements of Recommended Practice*

STEM — *Science, Technology, Engineering and Mathematics*
STFC – *Science and Technology Facilities Council*
UCL — *University College London*
UKRI – *UK Research and Innovation*

INTRODUCTION

The IMA enjoyed another good year in 2019. We ran the Department for Education Mathematics Initial Teacher Training Scholarships scheme for a seventh successful year recommending 208 outstanding applicants for scholarship funds.

Our eStudent offer continues to be highly popular, and following a refresh of our eStudent population, we had 7,000 eStudents at the end of 2019.

A third forum event for IMA Academic Representatives was held on 18 January 2019 in Birmingham. The Academic Representatives continue to work to strengthen links between their colleagues and students and the IMA, enhancing the promotion and support of mathematics within that sector of the community.

Our conference team ran 10 events, in several locations including Newcastle (Northumbria University) and Swansea.

We played the leading role with the CMS in the inclusion of mathematics within STEM for Britain at Parliament, and the final of the 2019 competition took place in Parliament on 13 March.

The IMA once again ran the maths stand at three outreach events: the Big Bang Fair alone welcomed 80,000 people, including more than 62,000 young people in 2019!

The IMA MathsCareers website attracted over 530,000 visits during the year and increased its followers on Twitter to 6,992. We also issued six more editions of our e16plus newsletter.

Council continued to work on its strategy development, in particular via the Membership Development Scheme (Communications and Marketing) Task Group and a Marketing Officer worked steadily in 2019 to advance this topic. Achievements included the launch of a new eBulletin for IMA members.

And on top of this we ran our regular activities covering branches, education, grants, journals, mathematics consultations and Mathematics Today.

We hope that you enjoy reading the comprehensive details in the rest of this report.

IMA AND GOVERNMENT

Both in its own right and as a member of CMS the IMA has been involved with a wide range of engagement activities in Parliament this year.

We continued to run the DfE Mathematics Teacher Training Scholarships scheme.

IMA Council members are in regular contact with DfE and UKRI.

On 13 March a panel of CMS judges, chaired by Tim Pedley, selected the Parliamentary and Scientific Committee STEM for Britain mathematics awards. Once again we are very grateful to the Clay Mathematics Institute and the Heilbronn Institute for their generous sponsorship of these prizes. STEM for Britain is the largest science event held in the Houses of Parliament on an annual basis and helps to strengthen our dialogue with Parliamentarians.

The Voice of the Future event took place on 12 March 2019. This is a great opportunity in Westminster for young scientists and engineers to put questions to key political figures.

The Parliamentary Links Day took place on 25 June at the Houses of Parliament on the theme of 'Science and the New Frontiers'. The IMA was represented at this event.

Our Executive Director, David Youdan, has continued to serve as an Advisor to the Parliamentary and Scientific Committee.

SERVICES TO MATHEMATICS

Outreach Fairs

The IMA attended three outreach events this year; the Big Bang Fair, Greenwich Maths Time - the 2019 IMA Festival of Mathematics and its Applications, and New Scientist Live. We are most grateful to our volunteers across these three events: John Meeson, Nira Chamberlain, Nathan Turner, Chris Budd, Declan Bays, Noel-Ann Bradshaw, Eduard Campillo-Funollet, George Daglish, Simon Geard, Jasbir

Grewal, Martin Keats, Karrie Liu, Andrew Silverman, and Jenny Venton. We are grateful to these members for their invaluable assistance.

For these events the IMA displays a range of engaging activities including: the Aerofoil, Travelling Salesman, Galton Board, and Foam cube challenge.

Research Committee

Professor Helen Wilson, Vice President Learned Society, chaired the Research Committee in 2019. The full membership of the Committee can be viewed on the IMA website: https://ima.org.uk/roles/research-committee/

These researchers contribute to our discussions with the research funding councils and policy makers, and work to promote the benefits of fundamental and applied mathematical research to the economy and to society. The Research Committee also assess applications for Small Grants.

Throughout the year, Research Committee worked on behalf of the community in many ways, including:
- the nomination of a young researcher to participate in the "Voice of the Future 2019" event, which provided a unique opportunity for young scientists and engineers to enjoy a 'Science Question Time' with panels which included several key political figures;

- the working group which was formed by the Committee in 2018 to consider IMA responses to Professor Bond's Review, "The Era of Mathematics, an independent review of knowledge exchange in the mathematical sciences", continued to meet in 2019 and has set up a information / discussion platform to keep in touch with those who signed up after the 1st IMA Conference on Knowledge Exchange in the Mathematical Sciences which took place in late 2018.

- the 'IMA Bond' working group and the Committee have liaised with the two CMS Committees which have been set up to take forward recommendations of the 'Bond Review' on behalf of the community.

Helen Wilson worked with IMA and LMS colleagues to organise a further joint IMA-LMS scientific meeting, which took place on 21 November 2019. On this occasion the theme was Mathematics of Planet Earth and thanks are given to all speakers, participants and Valerio Lucarini and other organisers, and the local hosting team at the University of Reading, for a successful and well-attended event.

Journals

The Institute's eight academic journals are published by Oxford University Press (OUP). From 2020 five of these will be traditional hybrid print journals:
- *IMA Journal of Applied Mathematics*
  Editors: Alan Champneys, (Bristol), and Demetrios Papageorgiou, (Imperial);

- *IMA Journal of Numerical Analysis*
  Editors: Arieh Iserles, (Cambridge) and Endre Süli, (Oxford);

- *Information and Inference: A Journal of the IMA*
  Editors: Robert Calderbank, (Duke); David Donoho, (Stanford); John Shawe-Taylor, (UCL) and Jared Tanner, (Oxford);

- *IMA Journal of Management Mathematics*
  Editors: Philip Scarf, (Salford); Aris Syntetos, (Cardiff) and Rogemar Mamon, (Western Ontario);

- *Teaching Mathematics and its Applications: an International Journal of the IMA*
  Editors: Duncan Lawson, (Coventry); Christopher Sangwin, (Edinburgh) and Cathy Smith (OU).

Two will be online only hybrid journals:
- *IMA Journal of Mathematical Control and Information*
  Editors: Nicos Karcanias, (City); Christophe Prieur (Grenoble); and Sarah Spurgeon OBE, (UCL).

- *Mathematical Medicine and Biology: A Journal of the IMA*

Editors: Oliver Jensen, (Manchester); John King, (Nottingham) and James Keener, (Utah);

One is an open access only online journal:
- *Transactions of Mathematics and its Applications*
  Editor in Chief: Arieh Iserles (Cambridge).

Five journals currently have impact factors (IF). During the most recent assessment period the IF increased for *IMA Management Mathematics* and *IMA Journal of Numerical Analysis*. The latter was a significant increase, from 1.837 to 2.397.

Conferences

The conference programme for 2019 is summarised below:
- *IMA Early Career Mathematicians' Spring Conference 2019*
  2 March 2019, Lancaster University

- *2nd IMA and OR Society Conference on Mathematics of Operational Research*
  25-26 April 2019, Aston University

- *3rd IMA Conference on Dense Granular Flows*
  1-4 July 2019, Centre for Mathematical Sciences, Cambridge

- *3rd IMA Conference on Nonlinearity and Coherent Structures*
  10-12 July 2019, Northumbria University

- *2nd IMA Conference on Inverse Problems from Theory to Application*
  4-6 September 2019, University College London

- *4th IMA International Conference on Flood Risk*
  12-13 September 2019, Swansea University

- *2nd New Lecturers' Induction Course*
  18-19 September 2019, Isaac Newton Institute, Cambridge

- *IMA Early Career Mathematicians' Autumn Conference 2019*
  26 October 2019, University of Bristol

- *LMS and IMA Joint Conference 2019*
  21 November 2019, University of Reading

- *17th IMA International Conference on Cryptography and Coding*
  16-18 December 2019, St Anne's College, Oxford

We started the year with a new conference team: Maya Everson and Cerys Thompson joined us at the end of 2018. They have worked with the organising committees to successfully deliver the 2019 programme of conferences and meetings for the mathematics community. In the main, the feedback from delegates was very positive, and those from industry and academics experienced in attending a range of conferences outside mathematics were content with conference prices. Some academic delegates were not content with our prices. All prices were set following the guidance of Council.

IMA Lectures

The 2019 IMA Lighthill Lecture at the BAMC at Bath was given by Thomas Hou. His title was "Singular Formation in 3D Euler Equations and Related Models".

On 26 June Reidun Twarock gave her Gold Medal lecture, "Geometry as a weapon in the fight against viral disease" to an audience of IMA members and invited guests.

Professor Alistair Fitt, IMA President, continued his tour of IMA branches with his Presidential Lecture "My Mathematics Bucket List".

Small Grants

The IMA's Small Grants Scheme is designed to be flexible, so that it can be used to facilitate any research activity within the scope of mathematics and its applications. Grants are available up to a value of £600 for individuals and up to £1,200 when enabling an event to take place. Applications are limited to IMA members only.

The budget for 2019 was £12,000. The Scheme received 31 applications, requesting a total amount of £20,660. Five applications were declined, 11 were awarded in full, and 15 were awarded a reduced amount. Awards for 2019 are shown on the IMA website.

Education

2019 was an active year for mathematics education. Our contribution was led by Mr Michael Grove (Honorary Secretary with responsibility for Education), supported by Professor Nigel Steele (Deputy Honorary Secretary Education), Professor Andrew Osbaldestin (Chair, HEdSA), Mr Christopher (Chris) Chipperton (Chair, S&FE) and Vanessa Thorogood (Education Manager) together with all our education committee members.

The Education Service Area actively promotes the engagement of the Institute's members in education with its work through communications by email, on the website, and in *Mathematics Today*. For instance:
- notification of the publication of key reports;
- invitations to participate in events and / or contribute to external initiatives;
- opportunity to provide feedback on specific issues;
- invitations to contribute to Institute responses to consultations;
- publication of the Institute's submissions to consultation exercises.

Selected highlights from another busy year are shown below:
- The Institute continues to be strongly supportive of the work of the Royal Society ACME, which has been redefined as a Standing Committee of the Royal Society. All four Contact Groups have now been established and Chris Chipperton agreed to join the KS3/GCSE Contact Group.

- Chris Chipperton also attended the Royal Society Business Forum: the role of post-16 education in ensuring workplace resilience. The Royal Society is bringing together industry leaders, policymakers and practitioners to explore how post-16 education can provide students with the skills they need to succeed in the changing world of work and how employers engage with schools to expand students' learning.

- Chris Chipperton was appointed as Secretary of The JMC in 2019.

- Professor Alistair Fitt (President) wrote to Alison Johns (Chief Executive of Advance HE) welcoming the announcement to establish subject networks, and ask that they do so in discussion with the learned and professional societies within the disciplines.

Higher Education Teaching and Learning Series
The *Higher Education Teaching and Learning Series* released its third call for applications in 2019, providing an opportunity for higher education mathematical sciences departments to request supporting funds for facilitating a teaching and learning related workshop. In 2019, the call was made in conjunction with the RSS.

In response to the call for proposals, ten proposals were received and six were successful, whilst two were asked to merge as they submitted similar proposals. The following workshops will be held in 2020:
- University of Birmingham - Making Mathematics Accessible to All

- Cardiff University & University of Bristol - Reflection? Action? Research: Enhancing Mathematical Research and Scholarship

- University of Glasgow - Assessment strategies for mathematical sciences in the digital era

- University of Nottingham - Project-based and synoptic modules

- University of Plymouth - Involving employers in the development of the mathematical sciences curriculum

- University of Sheffield - Effectively teaching small classes as a postgraduate demonstrator

Workshops from the successful applications to the

second call were held during 2019, these were:

- Moving beyond the examination – alternative approaches to assessment in the Mathematical Sciences and Engineering, Sheffield Hallam University and Queen's University Belfast

- Developing an undergraduate mathematics curriculum which is fit for purpose – challenges and opportunities, University of Liverpool

- Effective feedback in mathematics: provision and student engagement, Cardiff University

- Programming in the undergraduate mathematics curriculum, Middlesex University

As part of the IMA's Higher Education Teaching and Learning Series 2018/19 we were delighted to also include the following workshops:

- Putting Educational Research into Practice in HE Mathematics and Statistics Teaching, University of Edinburgh

- Effective Learning: Cognitive Psychology for Students and Lecturers, Loughborough University

Reports from each workshop are available on the IMA's Higher Education web page.

The Induction Course for New Lecturers took place on the 18-19 September 2019 at the Isaac Newton Institute for Mathematical Sciences. This course was designed by the mathematics community so that it is ideally suited for anyone who is new to or has limited experience of teaching mathematics or statistics within UK higher education.

Two one-day workshops for postgraduate students who teach mathematics and statistics took place; 4 October 2019 at the International Centre for Mathematical Sciences (Edinburgh) and 16 October 2019 at the Isaac Newton Institute for Mathematical Sciences (Cambridge). Aimed at postgraduate students who teach mathematics and statistics, these one-day events covered issues such as planning and preparing for teaching, facilitating problem solving

classes, encouraging participation and providing support, and assessing student work and providing feedback.

Programme Accreditation

The Institute's Programme Accreditation scheme accredits university degree programmes from which all its graduates will meet the educational requirements for the CMath designation. A total of 60 universities currently have degrees accredited by the Institute.

HEdSA has spent 2019 revising the current guidelines for Programme Accreditation, which will be implemented in 2020.

A list of accredited degree programmes can be found on the Programme Accreditation page of the Institute's website.

Schools and Further Education

Three new members joined the S&FE Committee in 2019; Dr Christopher Baker CMath CSci MIMA (Monks Walk School), Emma Davies (Heath Park School, Wolverhampton) and Sue Hough (Manchester Metropolitan University). Both Christopher Baker and Emma Davies are members of the Mathematics Teacher Training Scholarships Alumni.

The S&FE Committee has been concerned about significant issues with several aspects of the statistics component of the new GCE Mathematics, the use of large data sets. Chris Chipperton (Chair, S&FE) wrote to Professor Sir David Spiegelhalter (then President, RSS) to encourage him to initiate a conversation to start to explore the issues that are emerging around these qualifications.

HEdSA

Dr Noel-Ann Bradshaw CMath FIMA (London Metropolitan University) and Dr Gordon Bremner Laing CMathTeach CMath FIMA (Edge Hill University) joined the IMA's HE committee in 2019.

Education Grants

Individuals in schools, FE and HEIs in the UK can apply for a grant, normally up to a maximum of £600, to help with the costs of running or attending an educational activity relating to mathematics. The

Education Grants Judging Panel, consisting of the Institute's Honorary Secretary with Responsibility for Education and the Chairs of the education committees, decides on each application.

In 2019, new guidelines for the Education Grants were introduced to make it clearer what the IMA will award grants for. Also new for 2019 was the ability to apply online for an Education Grant through myIMA.

During 2019, the Education Grants scheme received 23 applications; of which 8 were awarded grants for the full amount requested, and 15 were declined.

The Education Grants awarded a total of £4,549.44 in 2019.

Applications approved for 2019 are shown from the on the Institute's website.

School Speaker

In 2019 requests for School Speakers were handled regionally, where appropriate, by IMA Branches.

Polymaths

Polymaths is a part-time open access course validated by the Institute offered by the University of Bolton. A total of 19 people were awarded the Polymaths certificate in 2019.

IMA MathsCareers

Site development work commenced on IMA MathsCareers during 2019 which affected audience figures. Despite this the site regularly received over 35,000 visits per month. During 2019 MathsCareers received 531,718 visits. The site is one of the top websites of its kind within the STEM community and continues to be popular among undergraduates seeking career advice as well as school audiences. New content on the site during 2019 included a series of articles aimed at undergraduates and post-16 students on study skills, as well as content on a variety of mathematical topics. Two contests are run every year where entrants submit posters on a mathematical theme.

Social Media is used to raise the profile of IMA MathsCareers, and it now has 6,922 followers on Twitter including several 'verified' followers. The profile of the site, as well as mathematics generally, is raised via the distribution of classroom posters.

Mathematics Teacher Training Scholarships

The IMA, working with LMS, MA, MEI, National STEM Learning Centre and RSS, delivered the Mathematics Teacher Training Scholarships on behalf of the Department for Education. The overall aim of the Scholarships scheme is to improve the quality, and widen the pool, of applicants for secondary teacher training by attracting highly qualified graduates and career-changers who might not normally consider teaching as a career.

The 2018/2019 (year 7) scheme was announced and opened for applications in October 2018, with a target of awarding 270 Scholarships to those who commence secondary mathematics teacher training in the 2019/20 academic year. This was another successful year, receiving 441 applications and awarding 208 Scholarships.

The eighth year (2019/20) of the Mathematics Teacher Training Scholarships was launched on the 11 October 2019. There a change to the financial incentives for those going into mathematics initial teacher training for both the government bursary and the Scholarships. The Maths Scholarship is now a £28k tax-free bursary during your initial teacher training year, followed by three later payments of at least £2k (enhanced payments of £3k if teaching in specified areas in England) in your 2nd, 3rd and 4th year of teaching, providing you have taught in a state-funded school in England since completing your ITT.

There are 270 Maths Scholarships available for individuals commencing secondary mathematics teacher training in the 2020/21 academic year.

Undergraduate and Postgraduate Liaison

The University Liaison activity increases membership, awareness of, and participation with the IMA amongst undergraduate and postgraduate students and the university community. This is achieved through newsletters to our 7,000 strong eStudent community, grants to mathematical

societies, careers talks for mathematics undergraduates and supporting careers events and student conferences. In 2019 we visited 41 different universities. There were 7 issues of the eStudent newsletter and, to keep it shorter and snappier, a blog site has been established for general skills articles such as objective setting and telephone interviews. The 'win an IMA water bottle competitions' have been well received and the tracking data is encouraging that current eStudents are engaging with the newsletters and the blog.

The spring and autumn ECM conferences were held at Lancaster and Bristol Universities respectively.

In 2019, £10,678 was paid in grants. Undergraduate awards were made to the Mathematical societies of the Universities of Aberdeen, Birmingham, Coventry, Dundee, Edinburgh, Glasgow, Heriot-Watt, King's College, London, Newcastle and Queen Mary University London. Awards were made to the IMA-SIAM Joint Student Chapters of the universities of Cardiff, Cambridge, Edinburgh/Heriot-Watt, Liverpool, Manchester, Nottingham, Reading, Strathclyde and Warwick. Sponsorship was also given for prizes for the Oxford Industrially Focused Mathematical Modelling (InFoMM) Camp, a speaker at the SIAM UKIE annual conference and support of the Tomorrow's Mathematicians Today conference at Greenwich and the SIAM UKIE Student annual conference at Manchester. Society activities supported included networking events, talks and participation in IMA conferences. The University Liaison Officer (ULO) delivered 24 careers talks and 2 workshops, and supported 6 careers fairs and 13 conferences, including the MEI Teachers' conference, Tomorrow's Mathematicians Today and the InFoMM camp. Maths Careers Ambassadors delivered 5 talks and supported 4 careers fairs and 2 conferences.

Academic Representatives

This scheme was established by the Institute in 2017, and we currently have 54 Representatives at 52 universities. Representatives are members of academic staff and it is envisaged that they highlight the work of the IMA in the community and beyond, to their students and colleagues, as well as providing feedback on the priorities of academic members. The third annual forum event for Representatives was held on 18 January 2019. During 2019 four AR Newsletters were sent to help to grow the full membership of students and academics. It is planned that the scheme will develop further over the next year.

Early Career Mathematicians' Group

The Early Career Mathematicians' (ECM) Group aims to provide those starting out in the profession with opportunities to develop their skills and network with peers. Two conferences were held this year, at Lancaster University in the spring and the University of Bristol in the autumn. Both conferences offered early-career members a varied programme of engaging talks. These conferences were organised with assistance from the Secretariat.

The ECM Group works closely with the University Liaison project to recruit student members and is also highly active on a range of social networking sites.

Professional Affairs

The Professional Affairs Committee (PAC) met three times during 2019. We welcomed Richard Pinch as new Chair of the Committee in January.

The main agenda item throughout the year was the work undertaken to progress the recommendations of the Bond Review report. Amongst other things, the Committee discussed study groups in the context of Bond and their value in promoting knowledge exchange, and it agreed that they should be supported wherever possible.

The committee also discussed the Big Mathematics Initiative (BMI) papers on an "Academy for the Mathematical Sciences" and "the case for a refresh of the Deloitte report" both of which are published on the CMS website. The Committee agreed that PAC would make representations on the importance of obtaining views on this from industry.

The Employers' Forum programme continued with the seventh event being hosted successfully by National Cyber Security Centre (NCSC) on 14 November 2019. The subject of the Forum was Knowledge Exchange and was attended by 54 delegates, with a mixture of professional backgrounds from industry, commerce and education. The day gave the delegates the

opportunity to listen to and discuss the practice and pitfalls of knowledge exchange.

Details of our Corporate Affiliate members can be found at:
https://ima.org.uk/affiliates/corporate-affiliates/

We are very grateful for the involvement of these organisations with mathematics and with the Institute.

Mathematics Today

In October the Biology and Medicine Special issue celebrated mathematical creativity in the versatile field of Mathematical Biology. Articles were on a wide range of subjects, including mathematical virology, graph and knot theory, big data, multiscale modelling and disease eradication. The issue was also guest edited and mainly written by women to show that this is possible and help redress an imbalance in *Mathematics Today* where most feature authors are male. All members are encouraged to continue submitting articles.

The Graham Hoare Prize 2019 was awarded to Lucia Karageorghis for her excellent article 'Paint by Number', which was published in the December 2019 issue. Lucia is a Student Member of the IMA and the first woman and first undergraduate to win the prize since we started running it as a competition in 2014.

The Catherine Richards Prize continues to select the best article published each year. The 2019 prize was awarded to Mark McCartney for his article, *Fluids, Fluorescence and a Hat Full of Beetles*, from the August issue.

The Institute was deeply saddened that the Editor of *Mathematics Today*, Edward Stansfield passed away during 2019.

IMA Website and Social Media

To foster engagement and raise awareness of the IMA our Communications Committee is encouraging regional branches to record talks. In 2019 three talks were recorded, published, and embedded on the IMA website. These talks have received 791 views.

The IMA's presence on social media has increased over the year. We have gained over 2,300 followers on Twitter, bringing our total to 13,800. Our LinkedIn company page has over 19,000 likes. Our Facebook page has 760 followers and Facebook group has over 4,100 members.

Google estimates demographic information about its users which it partially shares with us via our Google Analytics account. This demographic information extends to age and gender. Demographic information provided by Google Analytics of the visitors to the IMA website has been informative: in 2019 more than half of the visitors to the IMA site have been under 34 years of age (55.27%); and the gender distribution of total visitors is around 60/40 split of male to female (in comparison to the total IMA member split of 77/23 male to female).

IMA e16plus Newsletter

The e16plus Newsletter published six full editions in 2019. It is designed to inspire and raise interest in mathematics amongst 16- to 19-year olds and has 1,239 subscribers. The regular puzzle feature continues to be popular with readers, and the links in the Newsletter are designed to encourage engagement with MathsCareers and the IMA website.

Branches

Branches continue to be an important feature of the IMA, providing regional networking opportunities. They are run by committees of local members, with administrative support provided by the Secretariat.

The six active branches have held varied programmes of events for their members during 2019 and plans for the 2020 programme of talks are underway. The President toured the branch network during 2019, ending with a talk hosted by the West of England branch.

Members are encouraged to check the website for the latest branch activities in their region, and update their branch membership on myIMA to ensure that relevant circulations are received. Efforts to record talks and/or broadcast them via social media are expected to develop over the next year.

Some areas of the UK remain unrepresented by branches; members are encouraged to consider establishing new branches (or reviving dormant ones) in these areas, for which Secretariat assistance continues to be a high priority.

Diversity

The IMA is a signatory of the Science Council Declaration on Diversity, Equality and Inclusion, and Council has appointed champions to lead the IMA in this important agenda. Danielle Bewsher and Garrod Musto are thanked for their valuable contributions during their term as Diversity Champions, the end of which coincided with the end of their respective terms as IMA Councillors in June 2019. They were succeeded by Jenny Macey who, amongst other things, has developed plans to improve the IMA's diversity webpages for the benefit of members.

By identifying diversity as a cross-cutting theme in all IMA committee meetings many improvements have been identified and achieved. An anonymous diversity survey took place during 2019, and interesting results were subsequently reported in *Mathematics Today*.

MEMBERSHIP

The Membership Committee, chaired by Dr Charles Evans, is delegated, by Council, to assess individual membership applications. The Membership Committee is made up of Chartered Mathematicians who are Fellows of the Institute. They have a background in at least one of the following major areas of employment for mathematicians; academic research and teaching, schools and further education, industry, commerce, finance and IT.

We have had the privilege to welcome: 36 new Fellows; 55 new Members; 20 new Chartered Mathematicians and/or Chartered Scientists; 325 new Associate Members, 408 Students and 92 Affiliates. We have also had the great pleasure to support over 96 members transferring to higher grades.

Membership figures as at 31 December 2019 are:

Honorary Fellow	17
Fellow	1,418
Member	1,330
Associate Member	1,765
Affiliate	378
Student	617
Total	**5,525**

This represents a growth of 327 members in one year. Of the above memberships, 1,606 were registered as Chartered Mathematicians and 235 as Chartered Scientists.

The Institute has continued to support UK University Mathematics Departments by awarding over 140 IMA Graduate Prize Memberships in 2019.

Chartered Mathematics Teacher

The Chartered Mathematics Teacher Registration Authority consists of representatives from IMA, Association of Teachers of Mathematics, Mathematical Association, and National Association of Numeracy and Mathematics in Colleges. Dr Charles Evans, the chair of the Institute's Membership Committee, also chairs the Chartered Mathematics Teacher Registration Authority.

There are now 45 active Chartered Mathematics Teachers.

Membership Development Scheme

Our part-time Marketing Officer, Nikki Barnes, joined us in January. The Communications and Marketing Plan was approved in February and since then we have been implementing elements of it, such as:

- Launching a new membership eBulletin, bringing together news and articles of interest from the various parts of the IMA. The aim is to send the eBulletin on alternating months to *Mathematics Today* to ensure that members are kept informed about the IMA's activities.

- Reviewing and rewriting the membership web landing pages: the new web pages have been formatted for the website and uploaded at https://ima.org.uk/membership/ . The next

stage will be re-writing those pages which promote member value. The pages will include members' testimonials/ stories/ career journeys.

- Starting work on a new Annual Review to supplement the Annual Report as a promotional tool. This will contain a summary of activities with current photographs and infographics and will be published on the website.

- Attending outreach events such as New Scientist Live and the Festival of Mathematics.

The working group will review the Communications and Marketing Plan, and progress achieved, in early 2020.

GOVERNANCE

Professor Alistair Fitt, who became IMA President on 1 January 2018, chaired Council as it considered all the issues in this report.

In 2019, there were five nominations for the five vacancies on Council, so there was no need for a ballot. Council was pleased to welcome the following two new elected and three re-elected members in 2019: Dr David Boyce (elected), Professor Chris Breward (re-elected) Dr M Benjamin Dias (re-elected), Professor Catherine Hobbs (re-elected) and Dr Peter Rowlett (elected).

Additionally, Mr Aki Apostolou and Mr Edward Rochead were co-opted to council with effect from 1 January 2019.

Council continued to work on its strategy development, in particular via the Membership Development Scheme (Communications and Marketing) Task Group. Further investment in this area will take place in 2020.

All who sit on Council are the Trustees who approved this report. A full list of Council can be seen at the Governance web page.

Executive Board

The Executive Board involves all Honorary Officers

of the Institute together with Professor Nigel Steele and Dr Alan Stevens, as well as selected staff members from the Secretariat. The Executive Board continues to work very well with a role that is clearly complementary to that of Council.

IMA Committees

Details of leading IMA Committees are shown on the Governance webpages.

EXTERNAL RELATIONS
UK Mathematics Organisations

Council for the Mathematical Sciences (CMS)

CMS is composed of IMA, LMS, RSS, EdMS, and ORS, and has been chaired by Professor Sir Ian Diamond FBA, FRSE, FAcSS since September 2018. Many outside mathematics do not see the need for so many mathematics organisations. Those who only wish to deal with one authoritative organisation often deal with CMS.

A number of activities that relate to education and research were advanced together with our sister societies within CMS.

CMS continues to receive briefings from Royal Society ACME, which is funded by the IMA and others The CMS chair in 2019 was Professor Sir Ian Diamond.

CMS continued to promote the needs of mathematics to BEIS, DfE, UKRI, the House of Commons Science and Technology Committee, the House of Lords Science and Technology Committee, and the Scottish Funding Council.

CMS welcomed the Bond Review Report and is funding a task force to recommend how its recommendations may be advanced. It was agreed that to take forward the recommendations, a new initiative, known as *The Big Mathematics Initiative* should be established and during 2019 a Strategic Committee and an Implementation Group have been formed by CMS to advance these plans.

London Mathematical Society (LMS)

Throughout 2019 we continued to work with the LMS in many areas including research, Mathematics

Initial Teacher Training Scholarships and mathematics promotion.

Together we also award the David Crighton Medal for Services to Mathematics and the Mathematics Community, and the Christopher Zeeman Medal for Mathematics Promotion. Dr Hannah Fry's Christopher Zeeman Award Lecture was enjoyed on 5 March 2019, and Professor Ken Brown was awarded the 2019 David Crighton Medal, with his award lecture to take place on 23 April 2020.

On 21 November 2019 a well-attended, third joint scientific meeting of the current IMA-LMS series took place at the University of Reading on the theme of 'Mathematics of Planet Earth'.

The IMA continues to rent an office at De Morgan House. This facility allows us to maintain an excellent working relationship with the LMS.

The IMA Council continues to affirm that it wishes to fully embrace the concepts and principles of a New Unified Mathematics Society, and hopes that through constructive engagement the LMS and the IMA will be able to achieve this goal jointly at an agreed date in the future.

Other UK Mathematics Organisations

We continue to work closely with the Association of Teachers of Mathematics, the Mathematical Association and NANAMIC in the management of the Chartered Mathematics Teacher Registration Authority.

We also work closely with many sister organisations, Royal Society ACME, NCETM, and the Joint Mathematical Council to promote and support mathematics whenever possible.

The IMA has a representative who is an invited observer to the HoDoMS meetings and activities. The IMA always seeks to develop its higher education strategy in agreement with HoDoMS and the LMS.

UK SET and Others

Science Council

The IMA is a member of Science Council and continues to work cooperatively with Science Council to promote science, including mathematics, to Government.

Throughout 2019 the Chartered Scientist designation has continued to be popular with members with 235 holding the designation.

International

SIAM

IMA members who live in the UK may receive a discounted SIAM membership fee under our reciprocity agreement. (A reciprocal arrangement exists for SIAM members who live in the US). We have joint promotional campaigns and co-operative activities with SIAM and SIAM UKIE.

EuMS

The IMA is a member of the EuMS. IMA members pay their discounted subscriptions directly to EuMS.

ICIAM

The International Council for Industrial and Applied Mathematics was pleased to have IMA representation at the annual board meeting and industrial mathematics workshop in Valencia, the host for the 2019 conference. We contributed to the nomination of invited speakers for 2019, the election of the next president Yuan Ya-Xiang (a former student of Mike Powell), and the decision to award the 2023 conference to Tokyo.

A list of members who represented the IMA to STEM organisations in 2019 is presented in Appendix B.

SECRETARIAT

The Institute staffing at 1 /1/ 20 was:
Executive Director – David Youdan;
Assistant Director – Alan Peacock;
Conference and Administration Assistant – Cerys Thompson;
Conference Officer – Maya Everson;
Editorial Officer – Rebecca Waters;
Education Manager – Vanessa Thorogood;
Executive Manager – Alison Penry;
Membership Assistant – Sabeen Hansraj;
Membership Manager – Caroline Irwin;
Project Officer (Scholarships) – Cianne du Preez;

Services Officer – Gemma Reeves;
Services Officer – Joanna Baldacci;
Services Officer – Eugene Kidwell;
University Liaison Officer (0.6 FTE.) – Erica Tyson;
Administration Officer (part-time) – Karen Hedderley;
Administration Assistant (part-time) – Debbie Sullivan;
Conference Support Officer (part-time) – Pamela Bye;
Marketing Officer (part-time) – Nikki Barnes;
Membership Officer (part-time) – Natalie Stanton.

FINANCE

The final result was an unrestricted surplus of £49,548, compared with a budget deficit of £41,722. At the end of 2019 the total assets less current liabilities was £1,181,014. In 2018 the equivalent figure was £1,085,402.

Funds were used to support our charitable aims. There is a clear public benefit in our activities to support education, run educational conferences, to support mathematics to Government, and to regulate the professions of Chartered Mathematician and Chartered Mathematics Teacher.

Members receive a membership publication: Mathematics Today, six times a year. The revenue received from members' subscriptions exceeds the cost of providing membership services. The subscription surplus is spent on meeting our charitable objectives.

Notes to the Financial Statements for the year ended 31 December 2019

The accounts given in Appendix A represent an extract from the full formal financial statements, and should be read in conjunction with the 'accompanying notes'.

This Annual Report was approved by the Trustees at the Council meeting of March 2020.

The IMA Trustees

TRUSTEES' RESPONSIBILITIES IN THE PREPARATION OF FINANCIAL STATEMENTS

The Trustees (Council members) are responsible for preparing the Trustees' Annual Report and the Financial Statements in accordance with applicable law and United Kingdom Accounting Standards (United Kingdom Generally Accepted Accounting Practice).

The Royal Charter of Incorporation and the law applicable to charities in England & Wales requires the Trustees' (Council members) to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the Institute and of the incoming resources and application of resources of the Institute for that period. In preparing these financial statements, the Trustees (Council members) are required to:

- select suitable accounting policies and then apply them consistently;

- observe the methods and principles in the Charities SORP;

- make judgements and estimates that are reasonable and prudent;

- state whether applicable accounting standards have been followed, subject to any material departures disclosed and explained in the financial statements and;

- prepare the financial statements on the going concern basis unless it is inappropriate to presume that the Institute will continue in business.

The Trustees (Council members) are responsible for keeping proper accounting records that disclose with reasonable accuracy at any time the financial position of the Institute and to enable them to ensure that the financial statements comply with the Charities Act 2011, the Charity (Accounts and Reports) Regulations 2008 and the provisions of the Royal Charter of Incorporation. They are also responsible for safeguarding the assets of the Institute and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

ACCOUNTING POLICIES

The financial statements have been prepared in accordance with Accounting and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard in the UK and Republic of Ireland (FRS102) (Charities SORP (FRS102)) as updated by the Charities SORP (FRS 102) update bulletin 1, and the Charities Act 2011 and applicable regulations.

Stock is valued at the lower of cost and net realisable value. Net realisable value is based upon estimated selling price less further costs expected to be incurred to completion and disposal. Provision is made for obsolete and slow moving items.

Fixed assets include properties valued by Chartered Surveyors on an existing use/open market basis. Other fixed assets are stated at historical cost. No fixed asset under £250 is capitalised.

Depreciation is provided on all tangible fixed assets other than freehold land at rates calculated to write each asset down to its estimated residual value evenly over its expected useful life, as follows:-

Freehold buildings	2%
Fixtures, fittings and equipment	15%
Computer equipment	33%

All leases are "operating leases" and the annual rentals are charged to the Statement of Financial Activities on a straight line basis over the lease term.

Turnover represents the net amount charged to members and other customers net of Value Added Tax, for subscriptions and other services.

The Institute operates a defined contribution pension scheme. The amount charged to the Statement of Financial Activities in respect of pension costs and other post-retirement benefits are the contributions in the year.

INDEPENDENT AUDITORS' REPORT TO THE TRUSTEES OF THE INSTITUTE OF MATHEMATICS AND ITS APPLICATIONS

We have audited the financial statements of The Institute of Mathematics and its Applications for the year ended 31 December 2019. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom Accounting Standards (United Kingdom Generally Accepted Accounting Practice), including FRS 102 – (Charities SORP (FRS 102) as updated by the Charities SORP (FRS 102) update bulletin 1).

This report is made solely to the charity's trustees as a body, in accordance with the Charities Act 2011. Our audit work has been undertaken so that we might state to the charity's trustees those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the charity and the charity's Trustees as a body, for our audit work, for this report, or for the opinions we have formed.

RESPECTIVE RESPONSIBILITIES OF TRUSTEES AND AUDITOR

As explained more fully in the Statement of Trustees' responsibilities set out on page 15 the trustees are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view.

We have been appointed as auditors under section 144 of the Charities Act 2011 and report in accordance with regulations made under section 154 of that Act. Our responsibility is to audit and express an opinion on the financial statements in accordance with applicable law and International Standards on Auditing (UK and Ireland). Those standards require us to comply with the Auditing Practices Board's (APB's) Ethical Standards for Auditors.

SCOPE OF THE AUDIT OF THE FINANCIAL STATEMENTS

A description of the scope of an audit of financial statements is provided on the Financial Reporting Council's website:

https://www.frc.org.uk/auditors/audit-assurance/standards-and-guidance/current-auditing-standards.

OPINION ON FINANCIAL STATEMENTS

In our opinion the financial statements:
- give a true and fair view of the state of the charity's affairs as at 31 December 2019 and of its incoming resources and application of resources for the year then ended;
- have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice; and
- have been prepared in accordance with the requirements of the Charities Act 2011.

MATTERS ON WHICH WE ARE REQUIRED TO REPORT BY EXCEPTION

We have nothing to report in respect of the following matters where the Charities Act 2011 requires us to report to you if, in our opinion:
- the information given in the Trustees' Annual Report is not consistent with the financial statements; or
- the charity has not kept sufficient accounting records; or
- the financial statements are not in agreement with the accounting records and returns; or
- we have not received all the information and explanations we require for our audit.

Croucher Needham (Essex) LLP
Statutory Auditor
Market House
10 Market Walk
Saffron Walden
Essex
CB10 1JZ

25 March 2020

Note: Croucher Needham (Essex) LLP is eligible to act as an auditor in terms of section 1212 of the Companies Act 2006.

THE INSTITUTE OF MATHEMATICS AND ITS APPLICATIONS
INCOME AND EXPENDITURE ACCOUNT
FOR THE PERIOD 1st January - 31 December 2019

	Unrestricted Funds 2019 £	Restricted Funds 2019 £	Total Funds 2019 £	Total Funds 2018 £
Incoming resources				
Entrance/Transfer fees	4,193		4,193	4,348
Subscriptions	327,210		327,210	306,275
Publications	584,675		584,675	575,787
Miscellaneous Income	2,853		2,853	1,970
Appeal fund and bequests	410		410	397
Interest Received	8,580		8,580	10,392
Conference income	145,816		145,816	101,274
Careers in M & 50th Ann	1,700		1,700	1,144
Scholarships & HE STEM	137,789		137,789	191,803
	1,213,226	-	1,213,226	1,193,390
Resources expended				
Salaries, pension & NHI	552,698		552,698	552,136
Other staff expenses	11,798		11,798	17,524
Office overheads	31,725		31,725	29,071
Telephone	5,483		5,483	6,803
General printing, post. & stat.	14,937		14,937	18,285
Office equipment hire & maint.	2,389		2,389	2,669
Council and committee	51,910		51,910	29,032
Branches and groups	3,340		3,340	2,203
Education	11,233		11,233	11,015
Publications (inc. Maths Today)	70,152		70,152	84,473
General expenses	14,782		14,782	9,295
Bank charges	8,159		8,159	5,230
Legal and professional	2,500		2,500	-
Audit and accounts	32,391		32,391	8,167
Depreciation	10,231		10,231	7,970
Overseas activities	-		-	1,848
Amortisation of property	4,600		4,600	4,600
Subscription to other bodies	17,293		17,293	12,799
Repairs and renewals	6,592		6,592	1,140
Web-site expenses	10,501		10,501	4,680
Presidential Address	-		-	2,918
Conference Direct Costs	105,840		105,840	78,017
Grants/Donations	65,856		65,856	55,069
Strategy Review Weekend	-		-	-
Information Technology	2,387		2,387	2,381
I. T. Consultancy	1,320		1,320	4,287
Careers in M & 50th Ann	15,751		15,751	13,268
Scholarships & HE STEM	59,080		59,080	140,462
Irrecoverable VAT	14,769		14,769	-
Suspense Account	92		92	-
Bad Debt	-		-	-
De Morgan House Rental	8,991		8,991	12,909
De Morgan House furnishing	-		-	473
De Morgan House Other	4,428		4,428	4,825
18 Nelson Street Rental	5,521		5,521	5,000
18 Nelson Street Other	3,313		3,313	3,000
Development - SRW	7,590		7,590	5,224
Development - Membership Growth	3,027		3,027	11,175
Development - Database & Web	3,000		3,000	9,745
Development - Services	-		-	5,830
	1,163,677	-	1,163,677	1,163,523
Unrestricted Surplus/(Deficit)	49,549	-	49,549	29,867
Incoming resources				
Publications		80,000	80,000	80,000
	-	80,000	80,000	80,000
Resources expended				
Publications		33,939	33,939	53,745
	-	33,939	33,939	53,745
Restricted Surplus/(Deficit)	-	46,061	46,061	26,255
Overall Surplus/(Deficit)	49,549	46,061	95,611	56,122

THE INSTITUTE OF MATHEMATICS AND ITS APPLICATIONS
BALANCE SHEET AS AT 31 December 2019

	31 December 2019			31 December 2018	
	Unrestricted	**Restricted**	**Total**	**Total**	**Total**
	£	£	£	£	£
FIXED ASSETS					
Freehold Property	101,224			105,824	
Fixtures and equipment	13,526			12,291	
			114,750		118,115
CURRENT ASSETS					
Stocks	1,522			974	
Trade debtors	3,889			38,292	
Prepayments and accrued inc.	41,925			62,304	
Cash at bank and in hand	1,478,791			1,333,752	
	1,526,127	-	1,526,127	1,435,322	
CREDITORS due within 1 year	459,865		459,865	468,035	
NET CURRENT ASSETS/(LIABILITIES)			1,066,262		967,287
			1,181,014		1,085,402
CAPITAL AND RESERVES					
Income and expenditure account			1,103,624		1,054,076
Restricted income and expenditure account			77,388		31,326
			1,181,014		1,085,402
NOTES					
Creditors due within 1 year					
Trade creditors	33,250			40,759	
Social security and other taxes	59,264			64,796	
Accruals and deferred income	367,351			362,480	
	459,865			468,035	
INCOME AND EXPENDITURE ACCOUNT					
Balance as at 1st January 2019	1,054,076	31,325	1,085,402		
Surplus for the 12 months	49,548	46,063	95,612		
Balance as at 31 December 2019	1,103,624	77,388	1,181,014		

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The IMA continues to work with many organisations in Mathematics, Science and Engineering. The Institute's representatives were:

UK Maths

- **CMS**

  Professor A. Fitt (Oxford Brookes University)
  Professor H. Wilson (University College London)
  Mr D. Youdan (Executive Director)

- **Heads of Departments of Mathematical Sciences**

  Mr. M. Grove (University of Birmingham)

- **Joint Mathematical Council**

  Mr C. Chipperton (Formerly Alban C of E Academy), succeeded during the year by Professor P. Glaister (University of Reading)

- **sigma**

  Mr M. Grove (University of Birmingham)

UK SET and Others

- **Engineering Professors' Council**

  Professor C. Hobbs (University of the West of England)

- **Engineering UK and Engineering Council**

  Mr A. Peacock (Assistant Director)

  The Institute is a Professional Affiliate of the Engineering Council.

- **EPSRC**

  Professor A. Fitt (Oxford Brookes University)
  Professor H. Wilson (University College London)
  Mr D. Youdan (Executive Director)

- **Science Council**

  Mr A. Peacock (Assistant Director)
  Mr D. Youdan (Executive Director)

International

- **ICIAM**

  Professor I.D. Abrahams (Isaac Newton Institute for Mathematical Sciences)
  Professor I. Duff (STFC)