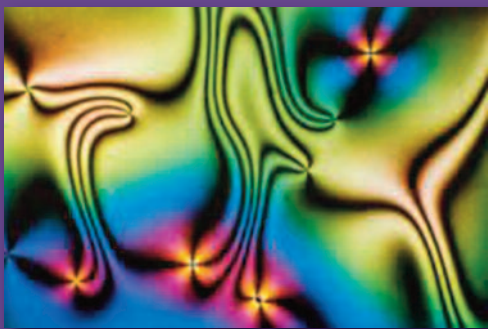
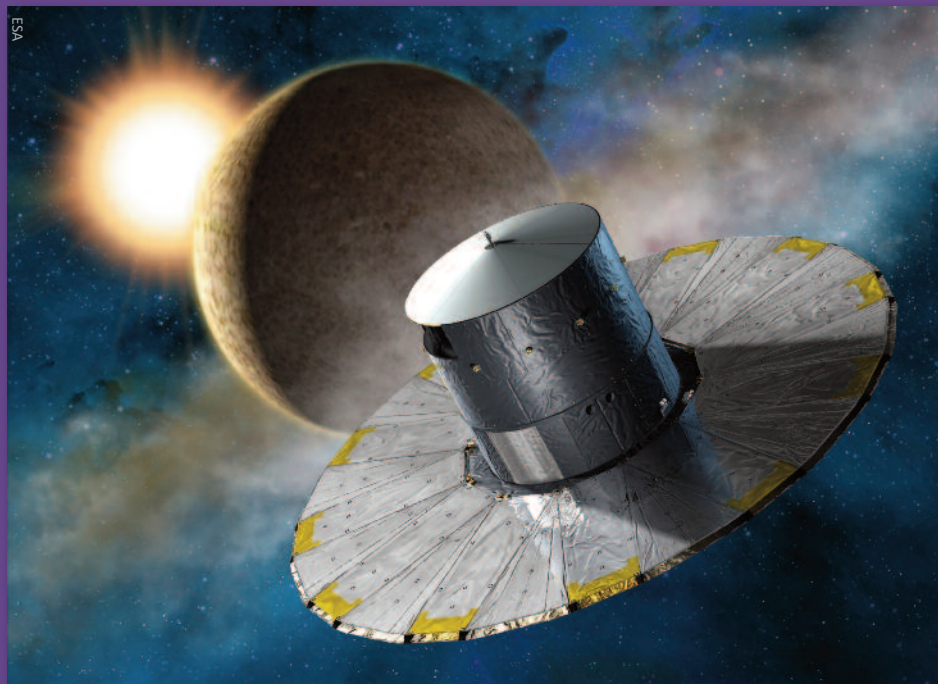




Turing Gateway to Mathematics

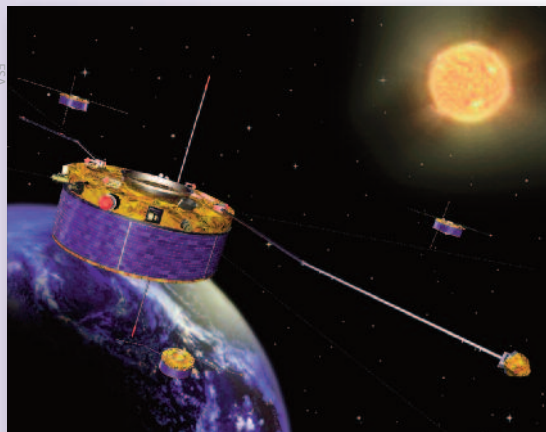
Annual Report 2013



UNIVERSITY OF
CAMBRIDGE

Overview

In March 2013, the Isaac Newton Institute for Mathematical Sciences (INI) launched the Turing Gateway to Mathematics (TGM). Named after Alan Turing because of his exceptionally wide influence across a very broad front, the Gateway has a national remit to increase knowledge exchange between the mathematical sciences and potential users. The TGM works closely with the INI which, as one of the leading national and international visitor research centres conducting frontier research across the mathematical sciences, is able to provide access to a huge network of high quality contacts from many different disciplines.



Mission Statement

“TGM aspires to facilitate the flow of knowledge and ideas from the mathematical sciences to potential users – in short, acting as a gateway! With activities ranging from specific projects to more extensive training and research programmes, the Gateway can help bridge the gap between academic mathematicians, business, government, and other disciplines. As well as focusing on widening access to mathematics generally, the TGM can also help shorten pathways to impacts and strengthen education and training in areas where maths skills are needed”.

Aims and Objectives

This new initiative aims to stimulate the interchange of knowledge and ideas between academics from different disciplines and users of modern mathematics, such as industry and policy makers. From financial risk and weather prediction to medical imaging and quantum computing, mathematics lies at the heart of many technologies used by a diverse range of businesses and government. The TGM can help facilitate access to experts with highly specialist mathematical knowledge and is becoming increasingly important for both businesses and the public sector.

The TGM initiates and fosters interactions and knowledge-sharing through structured workshops and meetings, and provides the physical space and facilities for small working groups of academics and business personnel to work collectively on problems.

This practical approach brings about the rapid generation and refinement of ideas, achieving intellectual breakthroughs with an immediate and positive impact on business, government and the wider economy. In medical imaging, for instance, mathematics can significantly improve imaging techniques in complex anatomical structures, leading to more accurate and effective cancer diagnostics. A key strength of the TGM is its ability to match mathematicians with business partners who require a particular set of mathematical skills and expertise. The Knowledge Transfer Facilitator therefore has a pivotal role in identifying potential research opportunities of mutual benefit to mathematicians and industry.

Gateway activities can include, but are not restricted to:

- ✦ workshops
- ✦ consultations
- ✦ training programmes
- ✦ short to medium-term research programmes
- ✦ scoping meetings to identify mathematical needs and challenges

Grants and Funding

Initially the TGM is funded by the University of Cambridge through the Higher Education Innovation Funding scheme. This funding covers the costs for the Knowledge Transfer Facilitator post, but there is currently no budget for TGM activities. Therefore all TGM activities require independent funding, for example through other public/government sources, industrial sponsorship, private philanthropy and participant registration fees.

Activities

Launch Events

A series of five events were held to launch the *Turing Gateway to Mathematics* over four days between 25–28 March 2013. The specific aim was to encourage early career researchers at graduate and post-doctoral level to meet with senior researchers and policy makers from government, industry and commerce, with input and steering from senior academics in the relevant fields. The events, which were geared towards providing introductions to some of the challenges posed by today's society, industry and commerce, were:

- Industrial Statistics (covering uncertainty quantification and computer experiments, big data and modes of collaboration between industry and academia)
- Policy Support in Communities and Local Government
- Stochastic and Statistical Models at the Interface of Modern Industry and the Mathematical Sciences
- Mathematics of Liquid Crystals: Industrially Inspired Problems
- Mathematics of Financial Risk Management

Energy Systems Week

This was a one-week workshop from 22–26 April 2013 and included an *Open for Business* event. The event originated from the 2010 INI programme *Stochastic Processes in Communication Sciences*. The workshop set out to address and make progress with some of the difficult problems now arising in large electrical energy networks, around the management of variability and uncertainty in these systems and forged sustainable and lasting industrial-academic partnerships in these areas.

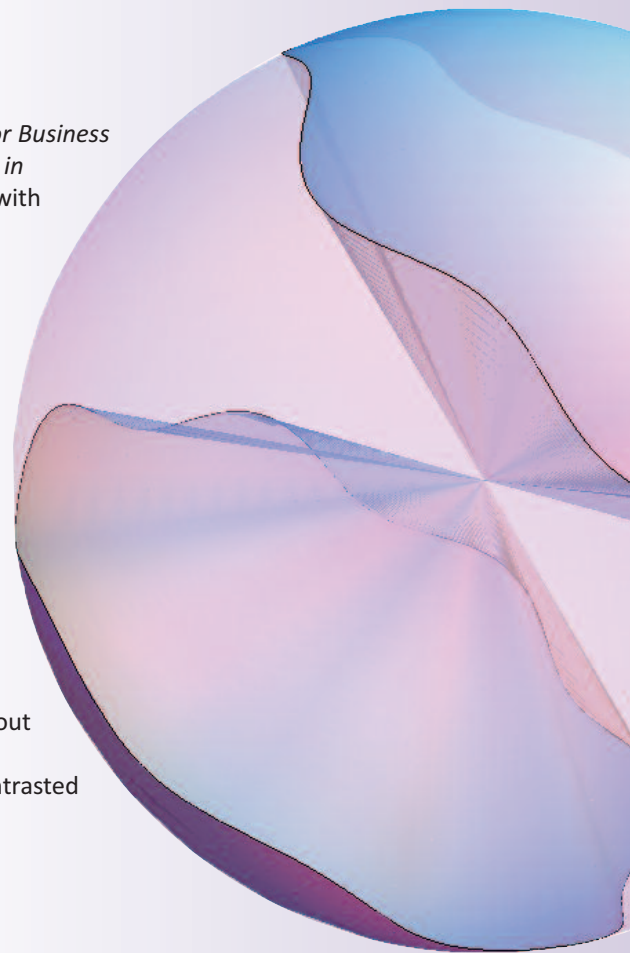
1st UK Optimisation in Space Engineering (OSE) Workshop

On 5–6 November 2013, the TGM in partnership with the European Space Agency (ESA) and the University of Southampton, ran the 1st UK Optimisation in Space Engineering (OSE) Workshop at the University of Birmingham. This resulted in the formation of a UK Working Group and a second larger workshop will take place in Cambridge 19–20 March 2014.

The 2nd OSE workshop will take forward challenges and issues identified in the 1st workshop, addressing these through a series of talks, discussion and break-out group type activities. Additionally, a number of example space engineering optimisation problems will be investigated and the solutions compared and contrasted to gain understanding of the efficiency of the various techniques.

Processing and Modelling of Earth Observation Data Consultation

On 4 December 2013 the TGM organised a meeting on *Processing and Modelling of Earth Observation Data* in consultation with the European Space Agency (ESA). This resulted in the generation of a number of ideas to be taken forward including: ocean modelling to influence/validate scatterometer algorithms for the measurement of wind speed/direction; synthetic aperture radar (SAR) data fusion techniques; robust automatic feature extraction to minimise costs of very manually intensive digitisation activities. Another key area was around a mathematical approach to assessing user needs for data service by developing rigorous sampling methodologies.



Future Activities and Strategy

Forthcoming activities and events

- Centre for Mathematical Sciences Showcase, 29 January 2014
- Mathematics for the Prediction of Financial Risk, 12 March 2014
- 2nd UK Optimisation in Space Engineering Workshop, 19–20 March 2014
- *Follow-up Meeting* to INI *Infectious Disease Modelling Programme*, 19 May – 6th June 2014 (tbc)
- NC3Rs/EPSRC POEMS Network Annual Maths in Biology Study Group Week, 8–12 September 2015
- Mathematical Modelling of Cardiovascular Variability in Animals Research Workshop, April 2015

Strategy

The TGM strategy for the forthcoming year is to continue to network across multiple disciplinary and technology areas in order to develop further projects and activities for knowledge transfer from the mathematical sciences. Long term working relationships are being fostered and will be further developed with the Technology Strategy Board Catapults. Sectors which will be particularly targeted in the forthcoming year include medical and biological sciences, financial services and space. A key part of this strategy includes targeting various government and non-government organisations and industry to obtain funding for TGM activities. This will take the form of one-off sponsorship of events, as well as larger commitments for programmes and longer term projects. The TGM will work hard to develop itself as the leading national vehicle for mathematical sciences knowledge exchange.

The Turing Gateway is a unique venture and fulfils a critical national need for mathematicians and businesses to have ready access to each other's ideas and expertise. Mathematics underpins the technologies and processes that drive modern business and the *Turing Gateway to Mathematics* has the potential and capacity to offer more industry-focused research projects in the future, further increasing its impact.



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