

# Newsletter

Engineering Mathematics

## The IMA - our professional body

Our degrees are accredited by the UK's Institute of Mathematics and Its Applications, who also sponsors prizes.



Before Christmas we were honoured to host an address from the outgoing **IMA President Prof Chris Linton** who spoke on the role of the mathematical sciences in society, the challenges we face and the importance of graduates who have exactly the kind of skills we teach in Engineering Mathematics.

For the past year, our Head of Department, **Prof Alan Champneys**, has written a regular feature in the IMA member's magazine *Mathematics Today*, called "*Westward Ho!, musing on mathematics and mechanics*". In each he discusses a local feature from the West of England and links it to a topic of relevance to modern applied mathematics.

The first piece was on **Cheese Rolling**, a strange Spring Bank holiday tradition that takes place at Cooper's hill near Gloucester. Here a double Gloucester is rolled down a steep hill and a crowd of mad revellers run, tumble and bounce after it, with the first to the bottom winning the cheese.



This led to a discussion on the mechanics of slipping, sticking and bouncing, and the modern theory of nonsmooth dynamics, that is a specialism of our Department.

Further articles have dealt with the mechanics of surfing, canal waves, and the most famous mathematician to come from the Devon village of Westward Ho! You can read about this and much more on the Eng Maths Blog.



## The Engineering Mathematics Society



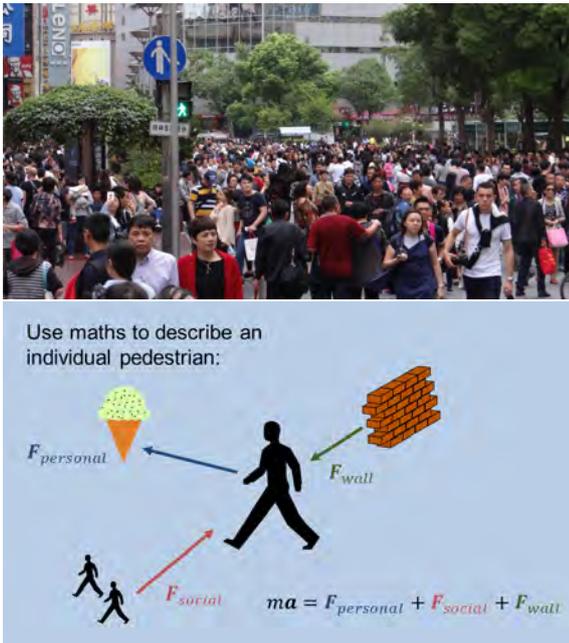
Our vibrant society runs industrial/academic talks and keeps up the yearly tradition of Eng Maths families (second year 'parents' paired with first year 'kids'). The society organises the **Pint of Eng Maths** nights, inviting lecturers to talks on their research and career in a casual setting. Among the first speakers was EngMaths Phd graduate John Lees-Miller talking about his company **Overleaf**, the online platform for the industry standard mathematical publishing language  $\LaTeX$  used by scientists all over the world (and taught to our students).

## Our new HackSpace



The HackSpace is a new, creative making space where students can experiment, build and explore new ideas.

## Computer games to aid evacuation



Emergencies that include the evacuation of large numbers of people from buildings or vehicles are unfortunately an almost inevitable consequence of increasing population sizes and urbanisation. To prepare for such emergencies, we need to understand how pedestrian crowds move during evacuations. Equipped with a good knowledge of what happens in such scenarios, we can formulate mathematical and computer models for pedestrian crowds and subsequently use these models to test the safety of building or vehicle designs before they are built. As part of his research, **Dr Nikolai Bode** (Vice-Chancellor’s research fellow in our Department) let people interact with models for pedestrian crowds in virtual experiments to test and extend our knowledge of how people behave in evacuations. Virtual experiments are essentially computer games and because he thinks this is a fun way to find out about research, he has recently developed online computer games everyone can play. If you want to find out more, go to [www.evacgame.eu](http://www.evacgame.eu)



## A spotlight on . . .

**Math and Data Modelling projects** In years 1-3, our students work, in groups, on challenging projects proposed by academics/industries. Here some examples. MDM3 project *Automatic Avalanche Airbag Deployment*: "Several companies are currently working on designing automatic avalanche airbags. We modelled the response of a ski-based sensor that would be able to deploy an airbag in the event of an avalanche, using the Doppler effect which indicates the velocity of the skier. Further, we looked into creating a network that could send signals to other skier’s airbags if they were in danger." *Yael Zekaria, 4th year student.* MDM3 project *Automated Composite Image Formation*: "We developed algorithms, like those used in the panoramic mode of smartphone cameras, to form one continuous picture from a given set of images captured using an Atomic Force Microscope (AFM)". *Matthew Uppington, 3rd year student.*

### Sensors for human-robot interaction

**Dr Nathan Lepora**, Reader in our Department, is developing tactile sensors for human-robot interactions and object manipulation. He recently developed TacTip family of sensors: a range of soft optical tactile sensors with various morphologies fabricated through dual-material 3D printing. These sensors are suitable for real-world applications in tactile perception, exploration and manipulation, and will enable further research and innovation in the field of soft tactile sensing. Read the full story at <https://doi.org/10.1089/soro.2017.0052>.

### Augmented robots for swarming applications

A collaboration between **Dr Sabine Hauert** from our Department and researchers in the Bristol Robotics Laboratory has led to the creation of Xpuck swarm, a new research platform with an aggregate raw processing power in excess of two teraflops.

The platform will be used for online evolution or learning of swarm controllers, simulation of what-if questions about possible actions, and real-world applications of swarm robotics that require image processing.



The full paper is at <https://doi.org/10.3389/frobt.2018.00011>.

### Other news

**Dr Colin Campbell** and colleagues have been awarded a large grant from MRC to use machine learning to find genetic disease subtypes. **Dr David Barton** and team have been awarded £2M from EPSRC for digital manufacture.