



Maths is beautiful and also very, very useful

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For most people pure maths can seem entirely theoretical and far removed from our daily lives. But whether we realise it or not there is advanced mathematical technologies at work all around us in the systems and machines that keep us safe and well, get us from A to B and keep us connected with one another.

Maria J Esteban has devoted her life's work to understanding and developing these mathematical technologies behind innovation. Appearing at the ICM 2018 to explain how mathematics is changing the world she urged mathematicians to recognize the value they bring to society and explained how maths really changes the world we live in.

Maria explained how, through techniques such as modelling, simulation and optimization mathematics is making breakthroughs and now directly contributes as much as 15% to the GDPs of countries like Britain, France and The Netherlands. In France, the number of jobs which require a high level of maths is now fully 10%.

Giving a huge range of examples from aerodynamics to heart-bypass operations and image processing, Esteban, at times, came across like a pure maths preacher, reminding attendees that "maths is beautiful as well as very useful" and will have more and more impact as we continue to develop new technologies. "All equations of physics and mechanics are written in mathematical terms." She pointed out. Therefore, "Maths is the language of science and the language of innovation."



From working out how hot airplane and rocket materials will get through friction with air; to designing models so doctors can avoid having to redo complicated heart surgeries; and help astrophysicists read messy images beamed back at them through space; maths and mathematicians are now more vital than ever.

Crossing the imaginary divide between disciplines has always been her greatest pleasure, using applied mathematics to help people understand the world. She told me how she was able to improve on an imperfect algorithm that quantum chemists had been using for years to understand the properties of materials and how they interact within a system. She was eventually invited to congresses to explain her work to experts in the field of chemistry. "I'm able to say that not only am I working on a problem, but I'm having a real impact on other people's lives and work. I'm really doing something that is useful and this feels good."

"How do you think Google became the best and most popular search engine in the world?" She asked the audience. "Using maths to develop better and better algorithms of course."

From the lectern she explained how recently, medium to small-sized companies all over the world are now realizing the potential of advanced mathematics to increase profits and squeeze costs and how this represents new opportunities which must be seized.

"Us mathematicians need to be conscious of the value we bring to the economy," she concluded. "We need to shout about this to push for more investments and more mathematicians to help improve the world and be more valued and appreciated around the globe."