News

Q&A Breaking the big one

Imperial's Darren Crowdy has achieved a mathematician's dream: solving a 140-year-old riddle.

10 Mar 2008 Angela Saini 0 comments

The youthful Chair in Applied Mathematics at Imperial College, Professor Darren Crowdy , has found a formula that could transform the way engineers work. He explained to Nature Network London how it feels to suddenly become a mathematical celebrity.

What was the problem you solved?

If you're an undergraduate engineer then you may have come across the fact that any polygon can be mapped to a simpler, circular shape using something called the Schwarz-Christoffel formula . This has helped engineers who need to calculate the resistance or heat conductivity across any shape of material, like a piece of metal. But until now if there was a hole in that polygon then there wasn't a formula that could deal with it.

For years, engineers have been using *ad hoc* methods and approximations to help them deal with the problem. But my formula allows them to compute it much more accurately.

How long did it take you to figure it out?

I was inspired to get involved with the problem in 2003. Other mathematicians had worked on it but had only managed to come up with partial solutions. One of my mentors once said to me, 'Darren, never solve a problem somebody else can solve.'

It wasn't until a year later that I worked out how to do it and then I spent time checking it. Even though my paper

was published more than a year ago, it only got a lot of interest after a major article in SIAM (Society for Industrial and Applied Mathematics) magazine this year.

And how did you do it?
My formula uses the Schottky-Klein prime function, which is specially tailored to solving problems involving shapes with holes. It was discovered more than a hundred years ago, but hardly any mathematicians use it. I myself only learned about it from a small chapter in a book that was first published in 1896. I took the original definition of the function and used its properties to find a new formula.

A few mathematicians have claimed they came up with a solution first Who's right?
I have never made a secret of the fact that I was listening to mathematician Alan Elcrat speak in 2003 on his solution to this same problem. He, along with Tom DeLillo and John Pfaltzgraff, did indeed find a formula but I knew that it wouldn't work in all situations. I realised that if a different formula could be found in terms of the Schottky-Klein prime function, then it would always be valid, for any shape with holes.

I have been in email discussions with Tom DeLillo who, since my work, has become a collaborator of mine. My own view is that they were first in writing down a partial solution, and I was first in writing the complete solution. I think friendly differences of viewpoint of this kind are healthy, and can promote scientific endeavour.

Some people have already called your formula a breakthrough—how often does something like this happen in mathematics?
It's quite rare for mathematicians to solve problems of this magnitude. The last really big one was the Poincaré Conjecture , which earned Grigori Perelman a Fields Medal in 2006, which is like the Nobel Prize of Mathematics.

Although my result perhaps isn't in the same league, it has a lot of practical use—a lot of mathematicians spend their time doing good work that appeals only to a small number of people. I don't know yet, but I'm quietly confident that history will judge this to be a breakthrough.

How has it changed your life?
I feel happier because I feel like I've made a difference.

A lot more people come to my seminars now. It is a sad fact that mathematicians by their nature don't publicise their work, like maybe medical researchers and engineers do. So for people to use my formula I have to talk about it, which means I have a very heavy travel schedule. Last year I went to Salt Lake City, Argentina and Canada—just some of the places I've had speaking engagements.

You've just turned 37. Given a lot of the greatest mathematicians did their best work while they were young, do you think you've reached your peak?
No, I think I can achieve more. This has spurred me on.

Image courtesy of Danielle Reeves

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