NUS National University of Singapore

IMS SCHOOL LECTURE

Jointly organized by

Institute for Mathematical Sciences, NUS

FoS Faculty of Science

National Junior College

Can a wire have a memory?

The search for optimal shapes has inspired scientists for centuries. A celebrated example is Johann Bernoulli's challenge at the end of the seventeenth century: Given the top and the bottom point of a slide, what shape would the slide need to have for a ball to slide from the top to the bottom in the shortest possible time? Is it a straight line, is it an arc of a circle, or is it a different curve?

Bernoulli's challenge is often regarded as the starting point for one of the most successful fields in mathematics, the so-called Calculus of Variations. Broadly speaking, it deals with all sorts of problems that require minimizing a suitable function. A good example would be the question how to find the minimum of the parabola $y=x^2$ (which would of course be the origin). In Bernoulli's example it is the time the ball takes to go from the top to the bottom of the slide. This is a more difficult task, and we will describe the solution only geometrically - it is an interesting curve which has a lot of fascinating properties.

Now how do all these relate to the title of this lecture? You might be tempted to say that a wire cannot possibly have a memory! However, I will show you that this is in fact possible by making an experiment with a so-called shape memory wire. Similar wires are being used today for example in stents in heart surgery. The explanation for this effect lies again in the fact that the wire tries to minimize something! These surprising connections between the century old field of the Calculus of Variations and modern applications to materials with memory have stimulated a lot of research in mathematics today.

- Date: 13 Jan 2005
- Venue: National JC
- Time: 2.50 to 3.40pm

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About The Speaker: Prof Georg Dolzmann (University of Maryland)

Prof. Dolzmann received his Ph.D. in mathematics from the University Bonn in 1992. After several years of postgraduate studies in Rome, Freiburg, Leipzig, Pittsburgh, and Pasadena, he accepted a position at the University of Maryland at College Park. In his research he combines theoretical and numerical techniques to the analysis and simulation of mathematical problems related to applications in materials science.