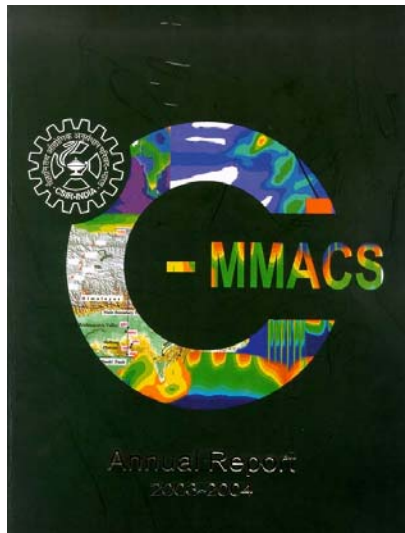


On Mathematical Proofs and Computers



Prof P Bhattacharyya, who retired a few weeks ago as Vice Chancellor, Tezpur University, delivered this year's C-MMACS Foundation Day lecture on 15 July 2004.

It was a remarkable lecture by a gentleman who introduced himself, with some pride I thought, as a "pure mathematician in the most traditional sense" ("not an 'applied' mathematician like some of you at C-MMACS!").

So what do pure mathematicians do? They prove theorems. How does one prove theorems? Well, there are direct proofs, proofs by induction, contradiction, construction and exhaustion... the sort of proofs that G H Hardy would approve of. What about probabilistic proofs? Hardy might have been less amused, but at least they were rigorous 'almost surely'.

What about automated theorem proving, i.e. proofs using electronic computers?. That, one suspects, would be sacrilege to Hardy and others of his ilk; including, indeed, Prof P Bhattacharyya!

In many ways, the good professor's lecture was a narrative – an extremely compelling one too, once he 'settled down' – where he, albeit reluctantly, persuades himself to accept that the world of mathematics, and mathematical proofs, is indeed changing.

It all started when the The Four Colour *Conjecture* (that any map requires only four colours to 'colour' different 'countries' in such a way that no two adjacent countries have the same colour), became the Four Colour *Theorem* in mid-1976. This should've been an occasion for much celebration, especially since the conjecture had remained unresolved for a few centuries. The rub was that the proof used a computer to establish that no minimum contradiction case existed.

Was this an acceptable mathematical 'proof? It of course was, but it wasn't 'beautiful'. It didn't please. It upset the applecart and the mindset. Even my own professor, the eminent Claude Berge, had described this proof – and don't miss the Frenchman's delightful sense of irony – as "70% true".

Almost two decades later came Andrew Wiles' proof of Fermat's Last Theorem. It took four years, and thousands of reams of computer stationery, to 'confirm' this proof. The traditional mathematician didn't like this proof either. What's worse, there was more evidence coming in to confirm all that Godel wrote -- in 1930 -- about 'undecidability'.

Prof Bhattacharyya explained how it's 'coming-of-age' time now for the traditional mathematician. "I don't much like all these new proofs, but I know that if I don't change my mindset, I'm going to lose out!".

So the curtain comes down with the good professor turning pragmatic. "Computers may not be so bad after all. A mathematician's computer could well become akin to the astronomer's telescope and the biologist's microscope. After all, how else could we have discovered the 41 st Mersenne prime?".

There were other delightful moments too at the Foundation Day function. Dr Gangan Prathap's charming introduction, Dr P S Goel, Director, ISAC's illuminating explanation of how to use ingenious mathematical ideas to convert a 5 km remote sensing resolution to a 1 km resolution, and Dr Anand Kumar's vote of thanks containing that endearing faux pas.

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