

Ten years of C-MMACS

This year's Foundation Day function of the CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS) was special. First, because C-MMACS has now achieved the milestone of completing ten years of existence, and, second, because the function featured a truly remarkable Foundation Day Lecture by Prof R Narasimha, FRS, on *Modelling and Simulation of Fluid Flows: Some Examples*.

The function opened shortly after 3 pm with a brief welcome speech by Dr R N Singh, Scientist-in-Charge, C-MMACS. Dr Singh recalled the many events which led to the formation of C-MMACS: how Dr D N Misra conceived the idea, how Prof V K Gaur and Prof Narasimha honed the concept ("often across Prof Gaur's dining table at Hyderabad", as Prof Narasimha later recalled) and how Dr K S Yajnik went on to convert the concept into a vibrant and successful modelling centre (one was particularly happy to greet Dr Yajnik at the function; the success of C-MMACS owes much to his drive and vision).

Dr Singh also presented a brief overview of the current activity at C-MMACS, the future focus ("modelling and simulation of complex fluid media -- ocean, atmosphere, lithosphere, polymers etc. -- and novel applications of nonlinear dynamics") and read out congratulatory messages to C-MMACS from Dr R A Mashelkar, FRS, DG-CSIR ("I visualise C-MMACS as an intellectual cauldron bubbling with ideas and cerebral ferment"), Dr Harsh K Gupta, Director, NGRI, Dr E Desa, Director, NIO and Dr Trevor Platt, FRS, from Canada's Bedford Institute of Oceanography.

Dr B R Pai, in his capacity as Acting Director, NAL -- Dr Prahlad is away in Germany for two weeks -- congratulated C-MMACS on its tenth anniversary and expressed his happiness at the growing interactions between NAL and C-MMACS ("whenever I log into the Internet, I see the C-MMACS logo first"). He also talked of the dramatic advances in computer modelling and visualisation ("I recently saw visualisations actually showing pockets of flames on the screen").

Prof Gaur, who presided over the function, then formally introduced Prof Narasimha. The introduction was affectionate and exceptionally articulate; Prof Gaur truly has a wonderful way with words. "Anniversaries are occasions for enlightened introspection, and can there be anyone better than Prof Narasimha to stimulate new thought?", Prof Gaur asked.

Prof Narasimha, who appeared a trifle overcome by the introduction to begin with ("it is going to be difficult to bear the burden of this introduction!"), quickly warmed up to the occasion and delivered one of his best lectures in recent times.

In the first part of his lecture, Prof Narasimha gave a historical perspective of mathematical modelling. "Mathematical modelling is not new; even the Greeks had models for planetary motion. Only the character of models is changing". Talking of Newton's 'model', Prof Narasimha observed that this was probably the first truly "sophisticated" mathematical model: "it was very 'economical' and could make incredibly accurate astronomical predictions". He then recalled Kelvin's view that "to understand physics, one must try to make a *mechanical* model" , and suggested that it was now time to replace the word *mechanical* with *mathematical*. "Constructing an appropriate mathematical model (to describe a certain phenomenon) is perhaps the most challenging (and profitable!) task of our time", he said. ("today's high technology is essentially *mathematical* technology", the CEO of a giant oil company recently told Prof Narasimha).

What are the attributes of a good mathematical model?. "Experimental agreement", Prof Narasimha remarked, "is obviously one criterion, especially in astronomy. But fluid dynamics can be very different; in physics we hope that the unknown will reveal itself in the form of simple mathematical laws, while in fluid mechanics the laws are well-known, but we are bothered by extremely complex behaviour!" And so the lecture continued, eventually culminating in a remarkably elegant enunciation on the nature (or behaviour) of fundamental

mathematical laws.

Another highlight of the lecture was Prof Narasimha's lucid classification of the different kinds of mathematical models: *impressionistic* (to gain insights into the structure with no claim to accuracy in prediction); *physical* (to predict quantities of interest based on assumptions not inconsistent with observed or understood physics -- and appealing to experimental data for model parameters if necessary); *rational* (simpler models derivable from more complete systems by limiting processes) and *ad hoc* (provide estimates of quantities of interest, especially in engineering applications).

Prof Narasimha ended his lecture with a discussion on modelling cloud-like flows (which has been the his ardent love for well over two years now!). It was therefore another remarkable performance from a gentleman who has just turned 65 years old, but whose scientific passion and curiosity apparently leaves him no time to age.

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