Editorial

Special Issue on Fluid Mechanics and Fluid Power (FMFP) and International Union of Theoretical and Applied Mechanics (IUTAM)

This special issue of Sadhana contains selected papers from two conferences related to fluid mechanics held in India recently, Fluid Mechanics and Fluid Power conference at NIT, Hamirpur, and an *International Union of Theoretical and Applied Mechanics (IUTAM)* symposium held at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.

Fluid mechanics touches almost all aspects of the natural and engineering world, and thus is of interest to engineers, mathematicians, physicists, biologists and earth and atmospheric scientists. It covers an incredibly large range of scales from flows in biological cells to convective flows in stars. An electrical engineer or an astro-physicist may be concerned about atmospheric turbulence which distorts electromagnetic waves; an earth scientist may simulate convection in the earth's mantle to understand plate tectonics or convection in the atmosphere to try to predict whether we will have a good monsoon; a gas turbine engine manufacturer will invest huge amounts of manpower and finances in order to improve the efficiency by fraction of a percent; a civil engineer would want to know if his multistoreyed building or his suspension bridge would collapse due to wind-induced resonance; it is of interest to know whether the flexible tail of a shark is more efficient than a propeller; the notoriously complicated and nonlinear Navier–Stokes equations governing fluid motion provide fertile ground for research to both applied and pure mathematicians. There is the phenomenon of turbulence in fluid flows. A statement in 1932, attributed to Horace Lamb, author of the famous book on hydrodynamics, perhaps says it best, "I am an old man now, and when I die and go to Heaven there are two matters on which I hope for enlightenment. One is *quantum electrodynamics* and the other is the *turbulent* motion of fluids. And about the former I am really rather optimistic". Nothing much seems to have changed much since 1932; turbulence is still a pressing problem.

The techniques to study fluid mechanics have evolved over time, initially being mostly mathematical and simple visualizations of flows. Prandtl's 1904 boundary layer theory, a revolution, allowed calculation of flows of practical importance, especially in aeronautics. Along with computers came computational fluid dynamics, making possible computations of more and more complex flows. At one time it was thought computers would make experiments obsolete; I remember a Senior Professor predicting wind tunnels would be used to store computer magnetic tapes. Of course, that prediction has been proved wrong: it is not possible to compute today, for example, even a relatively simple turbulent flow, leave alone, a more relevant flow of say combustion in an IC engine. Besides, experimental techniques, especially laser-based ones, have kept pace which allow detailed quantitative measurements of velocity fields in complex flows that no computer can compute. Both these developments, in computational science and experimental techniques, however, result in production of large amounts of data, often leaving a researcher wondering what to do with it! A simple, well thought out, flow visualization experiment or a computation can sometimes answer the question we are looking for. No amount of sophisticated computations or experiments can replace human insight and intuition; of course, they may produce innumerable, but eventually useless, publications!

The articles in this special issue of Sadhana exemplify the wide spread that fluid mechanics and its study represent. Section 1 has three review articles and some articles from the FMFP conference covering different facets of fluid mechanics. Section 2 is more focused, and contains articles related to flows in deformable tubes which find application in biological systems. Research in bio-fluid mechanics has tremendous growth recently, partly to address important questions in biological systems, like clogging of arteries, and partly to see if we can develop new engineering systems mimicking natural ones.

The recent editorial by Prof. N. Viswanadham "Why Sadhana?" (Vol. 39, June 2014, p. 532) highlights the need for the development of an entire ecosystem to promote excellence in science in India. One of the aims of Sadhana is to increase academic interaction within India. I hope this special issue will help in this direction, and will be useful to researchers and students of fluid mechanics.

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