Preface

Nonlinearity plays an important role in almost all fields of science and technology. Examples of areas where concepts like chaos, fractals, etc. developed through nonlinear studies have had an impact are:

Biology and image reconstruction
Chemical physics and material science
Control systems and meteorology
Ecology and plasma physics
Economics and statistical mechanics
Fluid mechanics

Given the varied nature of applications where nonlinearity is important, researchers in a broad range of fields have contributed to recent developments in the field. Consequently, interdisciplinary interaction has been largely responsible for the growth of the field and for its recent extraordinary pace of progress.

Two special issues of the *Journal of the Indian Institute of Science* on nonlinear dynamics are envisaged that reflect on the above interdisciplinary nature of the field. We have contributions from researchers working in several different areas of nonlinear dynamics. Nevertheless, this collection is far from being an exhaustive one and many important areas have been left out. The aim of these special issues is limited to providing a sampling of the problems being studied.

In the first issue, Vanninathan reviews recent developments and open problems in dynamical systems. This paper has appeared in a condensed form as status reports in the Department of Science and Technology (DST)'s Vision Papers on Mathematics (see *Mathematics Newsletter* of the Ramanujan Mathematical Society, Chennai, Vol. 6, no. 4; Vol. 7, nos 1 and 2, edited by R. Balakrishnan, Annamalai University). Sepcial thanks are due to Dr B. D. Acharya of the DST and Professor K. B. Sinha, Indian Statistical Institute (ISI), New Delhi, Chairman of DST's Programme Advisory Committee for Mathematics, for their kind permission to publish this paper.

Viswanath's article introduces the reader to the main concepts in artificial neural networks. He gives an interesting application of the theory to the biology of sleep. Vaidya proposes a novel technique for obtaining phase portraits of a dynamical system from empirical data. Janaki and Rangarajan review different techniques for computing Lyapunov exponents of continuous-time dynamical systems. Kolwankar gives an account of recent developments in fractional differential equations with special emphasis on applications to fractals.

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