Preface

The second of the Perspectives in Nonlinear Dynamics meetings, PNLD 2007, was held in Trieste, Italy, from July 16 to 27, as a satellite to the conference STATPHYS 23 which was held in Genoa. The linkage between the conferences seems natural, given the fact that much of the initial impetus to study nonlinear dynamical systems arose from considerations of statistical physics. This volume contains the proceedings of the conference which, like its predecessor, PNLD 2004, appeared to be an appropriate occasion for a discussion of the current status of the field. Given the setting, the International Centre for Theoretical Physics, there was a special effort to highlight the work on chaos and nonlinearity being carried out in the developing world as well, and also aimed to provide an opportunity for training and exposure. For this reason, the first four days, 16–20 July were planned in an intensive conference format, and 21–27 July were held in the workshop mode, with a combination of research and pedagogical talks, and focus sessions on emerging areas.

Since the first article in the volume by K R Sreenivasan offers a personal perspective and comments on the state of the field, here we will be somewhat brief and mainly discuss the organization of the articles in this volume.

We have been fortunate that the participation at the conference included several leaders in the field who have taken special trouble to contribute important articles with a pedagogical flavour to these proceedings. These include Jim Meiss' *Visual explorations of dynamics: the standard map* which forms a good companion piece to the computer program he has made available through his website. Another such article is the paper on techniques of *Simulations of granular matter* by Gabriel Pérez, and on *Transitions to turbulence in wall flows* by Paul Manneville. These articles are included in the first section of this volume.

The remaining articles in this volume are divided into three sections: Methodology, Applications, and Synchronization.

The articles in the methodology section cover a variety of phenomena. *Localized and nonlinear impurity modes in nonlinear chains* are discussed by Sarkar and Dey, whereas impurity dynamics in fluids is modelled by embedding maps by Thyagu and Gupte. Recurrence plots are used to analyse strange attractors by Ngamga *et al*, and techniques to assess the quality of stochastic oscillations are discussed by Abramson and Risau-Gusman. The next two articles discuss phenomena which arise in extended systems, spatio-temporal intermittency in a coupled map lattice (Jabeen *et al*), and synchronization and information transmission in a network of deformable units (Moukam Kakmeni and Baptista).

A noteworthy application of nonlinear dynamics to real systems was seen in the work of Mindlin and his group on the dynamical origins of birdsong. Mindlin's lectures on this topic at the workshop should serve to stimulate further work in the area. Applications of network ideas to diverse disciplines were extensively discussed at the meeting. These include studies of brain dynamics from the group of Kurths, and communication theory (Mukherjee *et al*, Tadić *et al*), where the network paradigm is most useful. Tadić and Levnajić also look at dynamic evolution of coupled maps on a scale-free tree, an unusual topology for such systems. Articles by Martí on time-delay and by Shrimali on asynchrony in updation dynamics also look at complex systems coupled in other interesting topologies, and Zemanová *et al* set up a network of networks as model of the brain. An article that stands a little apart is that of Bianconi which obtains the most probable degree distribution, given a fixed structural entropy, and thus gives a general formula which could be useful in a variety of contexts.

Synchronization in dynamical systems on complex networks formed a major theme of study. The articles which focus on this are included in the final section. The article by Muruganandam *et al* discusses analytic criteria for the detection of phase synchronization. Ando *et al* discuss the emergence of organized clusters in a network. The article by Nandi and Ramaswamy discusses the emergence of synchronization in the presence of noise. The final article of the issue, by Lou Pecora looks at the 'big picture' and gives a general framework in which the conditions for the synchronization of oscillators in complex networks can be found.

As can be seen, the three sections are multiply connected: a number of themes connect across the sections. A listing of these themes (which is by no means complete) would include synchrony, networks, time-delay, stochasticity, and complexity. At the same time, it has not been possible to represent here several areas of nonlinear dynamics which were discussed vigorously at the conference and workshop. These include non-equilibrium formulations of dynamical systems, the modelling of financial markets, predictions in climate and earthquake systems, topological effects in networks, and numerous biophysical applications. It has also not been possible to include a report of the focus sessions on extended systems (led by Chaté and Ginelli), biological systems (Mindlin and Ramaswamy) and networks (Amritkar and Bianconi). Also missing, regrettably, is a description of the 50 or so poster presentations at the meeting: these greatly contributed to the vitality of the conference.

Undoubtedly, some of the ideas presented here both in the talks and the posters will be crucial in sustaining the field and it will be interesting to assess their role in the further development and evolution of concepts in nonlinear science by the time STATPHYS 24 comes around.

This preface would not be complete without acknowledging all the people who made this conference possible. Prof. K R Sreenivasan, Director of the ICTP, Trieste has been a staunch supporter of the PNLD conferences in particular, and of nonlinear studies in general. Matteo Marsili has offered generous and unstinting support in both academic and administrative aspects of the conference. Lisa Iannitti, the conference secretary, brought her infectious enthusiasm and unfailing energy to take care of every administrative detail of the conference. This conference would not have run as smoothly as it did without her patience, and her concern for every participant, all hundred and twenty (or more) of us! We must also acknowledge the kind help from Hilda Cerdeira in the critical last stages of organization. And finally, we are especially grateful to the ICTP for giving us the opportunity – and the infrastructural support – to organize PNLD 2007.

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