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NEWS

In tune with the saga of chaos . . .

A national seminar on 'Computational Aspects in Chaos and Nonlinear Dynamics' was organized in the Department of Physics of Maharaja's College, Cochin during March 21–25, 1994. Thirty three delegates from the different key centres of research in the country in addition to a few local participants including college teachers and engineers, took part in the activity. The major issues discussed during the seminar include some of the recent trends developed to unveil the mystery behind chaos in nonlinear systems and attempts made to see if it can be tapped and tempered to our benefits and convenience.

Systems whose interaction laws are not linear, are blessed with a multiplicity of modes of behaviour and nonlinear coupling between different possible modes can lead to a randomness called 'chaos'. The dynamics then become extremely sensitive to initial conditions and therefore unpredictable in the long run. Our understanding of this fascinating dynamics has progressed in the past through the study of low dimensional nonlinear systems or simple iterated maps. However, the seminar witnessed a shift in emphasis to systems with nonlinear damping and nonpolynomial oscillators as well as iterated maps under periodic forcing or combination of maps leading to different dynamics.

In most of the biological systems, chaotic state is used for selection of useful activity patterns. However, in physical systems, randomness and unpredictability associated with chaos are to be either avoided or at least controlled. The seminar offered an opportunity to review different control mechanisms like adaptive control, synchronization, external forcing and noise, etc. Control mechanisms can be designed to increase mixing in chaotic systems and this was illustrated in the context of Williamonski–Rössler mass action model where increased mixing can lead to better yield.

We still entertain the hope that study of chaos can give us a leap forward in the study of the age-old problem of turbulence. Some realistic models that point a way to this goal were discussed during the seminar. Lattice structures with iterated maps at each site and nearest neighbour coupling show spatial period doubling and hence, organization of turbulence using temporally and spatially periodic orbits need not be a wild dream. A few specific cases like generation of coherent structures by introducing folds in maps like cat map and boundary layer induced structures in spatially extended systems, served to strengthen this view.

Chaos in quantum systems still remains an open problem with diverse approaches and interpretations. The seminar set the stage for discussing a few recent trends in this area like an arbitrary trajectory quantization scheme for particles moving on compact surfaces and purely quantal criteria for distinguishing between recurrent and non-recurrent dynamics. Regular and chaotic behaviour in field theoretic models like abelian Higgs and Skyrme models and Chern–Simons systems were presented in detail.

In addition to the above, several novel approaches came up during the seminar; the question of error growth in chaotic systems with noise, classification of phase transitions based on fractional calculus and hampering of learning processes in neural networks due to chaos etc., to mention a few. The seminar concluded with a general feeling that it is highly relevant to organize similar seminars in colleges where undergraduate and postgraduate students can get a feel of the whole feverish activity. This will certainly drive home the idea that there are many interesting things happening outside the covers of their textbooks.

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