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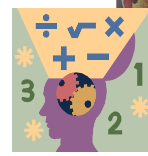
Hydrologic Sciences Graduate Group Presents

Special Colloquium Series, Spring & Fall 2005:

Between Nature and Science: Advanced Modeling Concepts for Environmental Sciences



John Rundle
Center for Computational Science and Engineering
University of California, Davis

Process, Pattern, Prediction: Understanding Complexity in Driven Dynamical Systems

Thursday May 19th
4:00-5:00pm
PES 3001
Light refreshments provided

Edward N Lorenz discovered that chaos and unpredictability are hallmarks of even simple driven systems. Predicting the future evolution of a variety of driven nonlinear systems is further complicated by the fact that their dynamical *processes* are 1) often not amenable to direct observation; and 2) are strongly multi-scale, so that length and time scales range from very much smaller and shorter than human perception, to very much larger and longer. An example of such systems is the atmosphere, in which, from a practical standpoint, it is impossible to measure the temperatures, pressures, and humidity at all locations at all times. Other important systems include neural networks and earthquake fault systems, both of which are examples of driven threshold systems. In systems such as these, we can only observe the space-time *patterns* of extreme events. Using these space-time patterns, and whatever is known about the dynamics of these high-dimensional nonlinear earth systems, it often possible to construct numerical simulations that can be used to make *predictions* about the future space-time evolution of the system and the possible occurrence of extreme events. The accuracy of these predictions and forecasts is limited by the proximity and similarity of the model trajectory through state space, to that of the actual system. The existence of flexible new Grid computing techniques made possible by the World Wide Web has opened new avenues for the realization of sophisticated, state-of-the-art numerical simulations. Thus our ability to forecast the extreme events of the future is limited by a range of issues originating from the dynamical process of interest, the space-time patterns we can observe, and the accuracy of the predictions that are desired.

Professor Rundle arrived at UC Davis in August, 2002. Previously, he was Professor of Physics at the University of Colorado, and Director of the Colorado Center for Chaos and Complexity (1993-2002). Prior to the University of Colorado, he was at Lawrence Livermore National Laboratories (1990-1993), and at Sandia National Laboratories, Albuquerque, (1977-1990). Professor Rundle was educated at Princeton University (BSE, 1972, Phi Beta Kappa, Tau Beta Pi) and the University of California-Los Angeles (MS, 1973, PhD, 1976). His research is focused on understanding the dynamics of earthquakes through numerical simulations; pattern analysis of complex systems; dynamics of driven nonlinear Earth systems; and adaptation in general complex systems. Among his recent honors, he is currently a Distinguished Visiting Scientist at the Jet Propulsion Laboratory in Pasadena, CA; he was also just honored for distinguished service as Chair of the Advisory Council of the Southern California Earthquake Center; he was recently elected a Fellow of the American Physical Society; and he was chosen to deliver the 4th Lorenz Lecture at the December 2004 American Geophysical Union meeting in San Francisco.

***Upcoming Speakers*:**

2-Jun **Jim Crutchfield** "Multiagent Dynamical Systems"

Sponsored By: John Muir Institute for the Environment, Computational Science and Engineering Center, Department of Civil and Environmental Engineering, Department of Land, Air, and Water Resources, Department of Chemical Engineering and Materials Science, Soil Sciences, Atmospheric Sciences, and Hydrologic Sciences Graduate Groups, College of Agriculture and Environmental Sciences, U.C. Cooperative Extension