SIXTH INTERNATIONAL CONFERENCE ON COMPLEX SYSTEMS

International Conference on Complex Systems (ICCS2006)

Boston, MA

June 25-30, 2006

Past conference programs:
ICCS 2004 | ICCS 2002 | ICCS 2000 | ICCS 1998 | ICCS 1997

Conference Aims:

1. To investigate those properties or characteristics common to complex systems, and
2. To encourage cross fertilization among the many disciplines involved

Conference Themes

Complex systems research in all areas

- Networks & Structural Themes
  In recent years, understanding the structure and function of complex networks has become the foundation for explaining many different real-world complex biological, technological and informal social phenomena. Techniques from statistical physics have been successfully applied to the analysis of these networks, and have uncovered surprising topological properties that have also been shown to have a major effect on their functionality, dynamics, robustness, and fragility. This conference will bring together the latest research and practice on the emerging science of complex networks.

  Topics include but are not limited to studies on:

  - Topological properties of networks
  - Growth of networks
  - Community structure
  - Dynamical processes on networks
  - Search and distributed computation on networks
  - Competition of evolving networks
  - Stability of networks
  - Optimization approaches on networks
  - Networks in biology - gene regulation, metabolic, ..., ecology and evolution
  - Networks in society - formal and informal social networks, technological networks
  - Networks in engineering
  - Spatial networks
  - Games on networks
  - Visualization of networks
- Systems biology
  High throughput data and theoretical modeling are combining to create new opportunities for systems understanding in biology. In addition to the comprehensiveness of genome-scale analysis of molecular pathways and networks, we are particularly interested in building toward an understanding of living systems at all scales and levels of organization. This will include aspects such as: emergence of higher-order (system-level) features, pattern formation, multiscale representation, etc. You are invited to submit abstracts/papers in experimental and theoretical areas of systems biology. Topics include but are not limited to studies on:
  - System levels
    - DNA/Protein sequence analysis: genome-scale comparative analysis, motifs, evolution
    - Regulatory pathways/circuits: stochastic simulation; deterministic, non-linear dynamics, in situ pathway visualization
    - Molecular networks: topology (global structure, local motifs) and dynamics
    - Cell and organismal physiology: Cell migration, Multi-cell behavior, Systems control, Homeostasis and disease, Scaling laws
    - Development: Spatiotemporal patterns, devlopmental constraints, robustness
    - Behavior: brain and behavior, group dynamics
    - Population and evolutionary dynamics
  - Concepts
    - Robustness and Control
    - Noise, Oscillations, Chaos
    - Fractals, power laws, Time series
    - Multiscale modeling
  - Tools
    - Genomics and Proteomics techniques
    - Databases, data mining, analysis and visualization tools
    - In situ imaging techniques (microscopic and macroscopic)
- Socio-economic systems
  There have been increasing interdisciplinary efforts to model and understand fundamental aspects of complex social and economic systems using tools from a variety of disciplines, including physics, computer science and network theory. Examples of topics pertinent to this section are
  - Traffic (automotive, pedestrian, information)
  - Stock and commodity markets

- Economic development and macroeconomics
- Urban planning
- Models of epidemics
- Counter-terrorism and security
- Voting and opinion dynamics
- Memetics
- Negotiation and coordination

We also welcome the presentation of new methods and tools applicable to these problems, including

- Agent-based models
- Cellular automata
- AI approaches
- Game theory
- Network analysis
- Time-series analysis and prediction
- Analytic methods

- Engineering systems
  - Characteristics of Complex Engineered Systems
    Modularity and industrial evolution; Non-linear and chaotic dynamics of engineered systems; Robustness, vulnerability and failure in CES; Self-similarity, critical phenomena, and power laws in CES
  - Networks in Complex Engineered Systems
    Network dynamics in CES; Scale-free and small-world networks; Effect of connectivity on CES performance; Robustness and vulnerability in networked complex systems
  - CES Paradigms Based on Natural Systems
    Biomorphic networks (Neural nets, artificial immune systems, etc.); Evolutionary approaches; Collective intelligence; Amorphous computing; Swarm robotics; Self-configuring robots, Animats/biomorphic robots; Self-organized sensor networks
  - CES Paradigms Based on Human Systems
    Game-theoretic paradigms; Economic paradigms; Social paradigms.
  - Product Design and Development
    Complexity-related methodologies in product development; Cooperative workgroups for collaborative product design
  - Managing Complex Engineered Systems
    Emergent/self-organized control methods for CES; Human-Computer Interactions; Managing the risk of CES accidents; Managing the risk of vulnerability to targeted attack
  - Ethical, Social, Economic and Political Dimensions of CES
    Accountability and responsibility in self-organized, decentralized systems; Dissociation of ownership and control in CES; Security in networked complex systems; Effect of CES paradigms on classical socioeconomic and political models; Resource utilization and costs in CES; Potential hazards of autonomous, adaptive complex systems to human society
  - Specific Complex Engineering Systems
    Ecology of the World Wide Web, Collaborating Distributed Micro-satellites, Smart Materials and Structures, Smart Retailing and Warehousing Environments, Intelligent Traffic Networks, Tissue Engineering
- Evolution and Ecology / Population change
- Nonlinear dynamics and Pattern formation
- Physical systems, Quantum and Classical
- Learning / Neural, Psychological and Psycho-Social Systems
- Concepts, Formalisms, Methods and Tools
- Analysis and Expression in the Arts and Humanities

Special Conference Sessions:

- GLOBAL SYSTEMS:
  This year's conference has a special focus day (Friday) and additional presentations throughout the week on global systems. Speakers, among others, are Steve Blount, head of Global Health at CDC, Dixie Snider, the chief scientist of the CDC, Frannie Leautier, the head of the World Bank Institute and VP of the World Bank, Hayward Alker, political scientist at USC, and Adm. Hogg, Director of the CNO Strategic Studies Group. Topics of presentations of interest include, but are not restricted to:
  - Socio-economic systems, including global development
  - Peace and conflict, including international security
  - Environmental concerns, including global warming
  - Health, including pandemics
- EVOLUTION AND ALTRUISM:
  Advances in our understanding of the evolutionary origins of altruism and collective behaviors will be discussed at the conference in multiple sessions. Keynotes will be given by E.O. Wilson and David Sloan Wilson.
- HOMELAND & INTERNATIONAL SECURITY:
  International terrorism, pandemics, and natural disasters are leading to a broad need for scientific complex systems based strategies. The Complex Systems community should respond by providing new insights tools and approaches informing policy, preparation and action. Sessions topics include, but are not restricted to:
  - Modeling and simulation of attacks, pandemics and disasters
  - Critical infrastructure protection
  - Network analysis of terrorism
  - Social processes of radical movements supporting terrorism
  - Analysis of effective and ineffective crisis response
  - Network analysis of transnational emergency response

  Among the speakers addressing this topic are Lt. Gen. Pat Hughes, Former director of DIA, Pete Gallant, Director of Global Security, World Bank, as well as speakers in the Global Systems program (see above).
- EDUCATING ABOUT COMPLEX SYSTEMS:
  The major advances in complex systems research have led to increasing interest in developing educational programs that train students to think about the rich and sometimes difficult concepts of complex systems. We will have sessions on how to teach complex systems concepts. Contributions about all levels of education are welcome.
- EDUCATION SYSTEM REFORM:
  Frustrations about the education system and existing efforts at reform are leading to a need for complex systems insights on education system reform. A special session or multiple sessions will address this topic.
- SCIENCE FICTION:
  We are organizing special sessions on the exploration of complex systems concepts in the science fiction literature. Jonathan Vos Post (webmaster of magicdragon.com) will be chairing this conference thread including participation of Hugo & Nebula Award winner David Brin and other science fiction writers. Science fiction stories and novels explore our ideas about phy-bio-socio-tech relationships. They are not as much about the future as much as they are about our understanding of what is possible. Such explorations probe our understanding about the dependencies between environment, technology, biology and society. If we understand what possible social systems are, we have understood much about the nature of such systems. Similarly for biological systems, or combinations of biology

and society, and so on. The synergy between this exploration and the study of complex systems should be apparent and we look forward to a fruitful dialog.

- BIODIVERSITY, SPECIATION AND ECOLOGY:
  Increasingly the discussion of evolutionary change is coupled to our understanding of ecological systems. Among the topics of interest are biodiversity, spatial populations, conservation, species vulnerability, speciation, and major evolutionary transitions.

- BIOMEDICAL SIMULATION AND SYNTHETIC BIOLOGY:
  We will be conducting one or more sessions on the macro and micro level modeling, design, synthesis, and novel utilization of existing biological systems, the modeling of physiological systems, and the development of new approaches to biomedical research.

LEARN

RESEARCH

ENGAGE

ANALYTICS

SUPPORT
THE MISSION

ABOUT