Mathematics for the future: Brain, biological systems, and social systems

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AIHARA LAB.

[Complex Systems Mathematical Modeling]

Department of Informatics and Electronics, Institute of Industrial Science Dept. of Mathematical Informatics, Grad. School of Information Science and Technology Dept. of Electrical Engineering and Information Systems, Grad. School of Engineering

> http://www.sat.t.u-tokyo.ac.jp/index.html Special Field of Study: Biological Information Systems

Complex Systems Mathematical Modeling

We study a variety of complex systems and problems—biological systems, social systems, economic systems, diseases, energy problems, natural disasters, and so on—through mathematical modeling and data analyses. We also try to establish fundamental theories and methods for analyzing those specific systems. We aim at further development of researches based on the joint works with the Collaborative Research Center for Innovative Mathematical Modelling.

Dynamics of Neural Networks and Information Processing

We are trying to clarify the mechanism of real neural networks and to reveal the high-order functions of the brain through developing mathematical models of neurons/neural networks and identifying underlying non-trivial mathematical structure. As an application, we are also developing analog silicon neural



Applications of chaos and fractal:

neuro computer Nonlinear Systems Analysis and Its Applications

We are studying chaos and many other complex phenomena in the world that have some regularity behind the complexity, by using nonlinear dynamical systems theory. We focus on the "nonlinearity" of the target systems, develop mathematical models that can reproduce the complex phenomena, and analyze the models to reveal the essential factors. Topics include: synchronization of coupled oscillators, forecast of renewable energy generation, analysis of economic and seismic data, etc.

Mathematical Modeling of Diseases

We are applying our methods for mathematical modeling of complex systems to specific issues in the field of medicine and epidemiology. For example, we have investigated pandemics of new infectious diseases by both multi-agent simulations and analyses based on complex



Simulator of influenza

network theory and proposed effective countermeasures.





Institute of Industrial Science