

Yoshifumi NISHIO
Professor, Tokushima University, Japan



KEYNOTE IV: SOLVING COMBINATORIAL OPTIMIZATION PROBLEMS EXPLOITING NEURAL NETWORK AND CHAOS

Abstract:

Solving combinatorial optimization problems is one of the important applications of the neural network (abbr. NN). If we choose connection weights between neurons of the Hopfield NN appropriately according to given problems, we can obtain a good solution by the energy minimization principle. However, the solutions are often trapped into a local minimum and do not reach the global minimum (namely optimal solution). In order to avoid this critical problem, several people proposed the method adding some kinds of noise for solving the problems with the Hopfield NN.

On the other hand, nonlinear systems often produce irregular oscillations even without any external noise. Such oscillations are called "chaos" and are investigated extensively in the past 30 years. Chaos sometimes looks similar to noise but is different in the sense that chaos obeys deterministic equations and hence has a certain level of regularity.

In this talk, I start from the basic of chaos and explain the feature of chaos. Then, some simulation results show that chaos can be exploited to enhance the ability of the neural networks for solving combinatorial optimization problems.

Biography:

Yoshifumi Nishio received B.E., M.E., and Ph.D. degrees in electrical engineering from Keio University, Yokohama Japan, in 1988, 1990, and 1993, respectively. In 1993, he joined the Department of Electrical and Electronic Engineering at Tokushima University, Tokushima Japan, where he is currently a Professor. From May 2000 he spent a year in the Laboratory of Nonlinear Systems (LANOS) at the Swiss Federal Institute of Technology Lausanne (EPFL) as a Visiting Professor.

His research interests include analysis and application of chaos in electrical circuits, analysis of synchronization in coupled oscillatory circuits, development of analyzing methods for nonlinear circuits, theory and application of cellular neural networks, and neural network architecture. He is author or co-author of more than 400 journal/conference papers. He was the Chair of the IEEE CAS Society Technical

Committee on Nonlinear Circuits and Systems (NCAS) during 2004--2005, the Steering Committee Secretary of the IEICE Research Society of Nonlinear Theory and its Applications (NOLTA) during 2004--2007, and is currently the Secretary/Treasurer of the IEEE CAS Society Shikoku Chapter. He was an Associate Editor of *the IEEE Transactions on Circuits and Systems--I: Regular Papers* during 2004--2005, and is currently serving as an Associate Editor for *the IEEE CAS Magazine*, *the IEEE CAS Society Newsletter*, and the *RISP Journal of Signal Processing*. He is also the Editor of *the IEICE Fundamentals Review* and is a member of the Editorial Board of International Journal of Circuit Theory and Applications. He is a senior member of the IEEE, and a member of the IEICE and the RISP.