

# Synchronization phenomena in large-scale neural networks

Kęstutis Pyragas

Department of Fundamental Research

Synchronization is a universal phenomenon characteristic of systems of interacting nonlinear oscillators. In the nervous system, synchronization processes play an important role, as they are responsible for information processing and motor control. However, excessive pathological synchronization can seriously impair brain function and is a symptom of some neurological disorders such as Parkinson's disease. Since real neural networks consist of a huge number of neurons and each neuron interacts with thousands of other neurons, direct computer simulation of such a complex system is impossible. Recently, a method has been developed that allows the microscopic equations of large neural networks to be reduced to low-dimensional macroscopic models. Such mean-field models are effective for studying synchronization processes in large-scale neural networks and for designing efficient synchronization suppression algorithms aimed at eliminating harmful synchronization.