Desynchronization of oscillatory networks by intermittent delayed feedback control

Irmantas Ratas, Kestutis Pyragas

Semiconductor Physics Institute of Center for Physical Sciences and Technology, A. Gostauto 11, LT-01108 Vilnius, Lithuania

We propose the new algorithm for desynchronization of globally coupled oscillators. The problem is actual for neuroscience, where the suppression of pathological neuronal synchronization may remove the symptoms of various diseases. Our algorithm is based on the periodically intermittent delayed feedback control. The algorithm consists of two stages. In the first stage, we measure and memorize the output of the control-free system. In the second stage, we apply the feedback control using the memorized signal. Operation of the algorithm is demonstrated by numerical experiments with all-to-all coupled Landau-Stuart oscillators and Hodgkin-Huxley neurons. From these experiments we found that it is possible to implement charge balance condition for Hodgkin-Huxley network. In the limit of infinite large population of Landau-Stuart oscillators some analytical estimations are derived. Our approach is particularly important for applications to physical and biological systems which do not allow for a simultaneous registration and stimulation at the same time.

Key words: desynchronization, intermittent feedback control, Landau-Stuart oscillators, Hodgkin-Huxley model