Dynamical Properties of Firing Patterns in Spiking Neurons

Wook Hee Koh

Department of Computational Applied Physics
Hanseo University
Seosan, Choongnam, Korea

The information between neurons in brain is exchanged by producing trains of individual spikes. These spike trains carry information coded by their temporal patterning, which is often highly irregular across time. To study the dynamics of spike behavior, recently, several two-dimensional spiking neuron models have been introduced. Among these models, the adaptive integrate-and-fire model can generate various irregular firing patterns, and also is effective computationally. This model is described by two differential equations of two variables, the membrane potential and adaptation current, with the reset. We developed a numerical code using adaptive integrated-and-fire model to simulate the dynamical properties of firing patterns of neurons. The simulation results show that spike trains have a complex bifurcation structure and spike patterns are chaotic for some parameter values.