Preface

Both noise and time delay play important roles in regulating the dynamical behavior in complex systems, such as chemical oscillator, nonlinear circuits, nerve system and networks. It is ever thought that noise can cause breakdown or irregularity of the nonlinear dynamical systems, for example, the thermal noise in circuit could decrease the quality of signals. Indeed, noise often plays a positive role in excitable media; it is found that the regularity can be enhanced under intermediate noise intensity. One distinct example is supported as coherence resonance or stochastic resonance that appropriate noise intensity can enhance the temporal order, regularity, signal-to-noise ratio (SNR), and even spatial regularity in network. In theoretical studies, *Gaussian white noise*, *Gaussian colored noise*, *Lévy noise*, and *phase noise* are often considered in additive or multiplicative type. For biological neurons, channel noise is often considered for transition of electric activities. In the field of pattern selection and control, it is found that noise often cause breakup of target wave and spiral wave, while appropriate noise intensity is important to support the emergence of spiral wave that keeps the network under distinct spatial regularity like a pacemaker.

In the case of time delay, time-delayed feedback scheme is often used to stabilize irregular vibration of motors, hanging beams, signal generators. In dynamical view, a time-delayed term is imposed on the dynamical system in close loop. Its distinct advantage could be that this type of feedback doesn't change the intrinsic structure and the control is stopped automatically when the target is reached. In realistic systems, time delay is often considered due to its potential generation mechanism. The first type of time delay is called as propagation delay that finite time period is taken during the transmission of signals between the signal sender and receiver, and this time delay is often considered in network problems. The second type of time delay is called as processing delay or intrinsic delay that the finite time period is required when external forcing is processed and appropriate response is generated. It is confirmed that noise is able to enhance the memory time in a dual-time positive-feedback gene regulatory circuit, and time delay could also play constructive role in this noise-enhanced biological memory. It is believed that memory effect could be measured by time delay while others claimed that memristor can do the same thing well. Therefore, time-delayed or memristive networks are designed to investigate the signal processing problems. For further introduction about noise effect please refer to the monograph edited by Tang Jun, *Positive effect of noise on the biological system*, China University of Mining and Technology Press, 2015.

In the case of neuronal network, time delay and noise are often considered to understand the information encoding and dynamical behaviors of neurons. As a result, network of neurons is designed under appropriate topology to study the transition of synchronization, pattern selection and control, stability of collective behaviors, spatial fluctuation. Some biological evidences confirmed that interneurons developed a specific synapse-autapse, that neuron re-connects to its body via synapse, and this effect is often described by using a time-delayed feedback current on the membrane potential of neuron. As a result, time delay and noise should be considered in dealing with control of realistic engineering problems and biological systems.

Science China Technological Sciences (Sci China Tech Sci) is a great platform globally for all scientists and technologists to share their basic and innovative research results in the fields of natural sciences and high technologies, focusing on the breakthroughs all over the world. We hope this issue may be useful to those researchers who are now working on complex network, computational neuroscience, dynamical control, and neurodynamics.

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