Abstract

This thesis is mainly dealt with the dissipativity and passivity problems for neural networks with time-delays in the continuous-time domain. Dissipativity theory is an effective tool to analyse the stability of the dynamical systems using only the general characteristics of the input-output dynamics of the systems. Passivity and dissipativity analysis for neural networks with time-delays have been an active research area for the last few decades. The main reason is that time-delay frequently occurs in many practical systems such as engineering, biological, manufacturing system and telecommunication. The existence of time delays may cause undesirable dynamic behaviours, such as oscillation and instability. On the other hand, the presence of uncertainties in system parameters, nonlinearities and noise disturbances can cause undesirable dynamic behaviors of the proposed model. Hence it is necessary to investigate the passivity and dissipativity analysis of NNs with time-delays.

In this thesis, passivity and dissipativity conditions are derived for MJNNs, SNNs, T-S FNNs, T-S fuzzy CGNNs, MRNNs and neutral type NNs. For the above mentioned problems, sufficient passivity and dissipativity conditions are derived by constructing suitable LKF based on Lyapunov stability theory and LMI technique. By utilizing the novel LKFs and employing various techniques such as Wirtinger based double integral inequality, Free-matrix based integral inequality, quadratic convex combination technique, second order reciprocal convex combination technique, multiple integral inequality and delay decomposition approach, some novel delay-dependent passivity and dissipativity criteria are established. These conditions are solved by using standard mathematical softwares. The effectiveness and less conservatism of the proposed methodologies are confirmed on extensively tested examples.