Abstract

This planned thesis work is concerned with the problem of analysis on stability of neural networks with time-varying delays in continuous-time case. The stability of time-delayed neural networks have been received much attention from many researchers owing to its potential and fruitful applications in different fields such as ultrasonic, weather forecasting, secure communication, signal processing, pattern recognition, optimal control, quantum waves, engineering computing and associative memory, etc. Further, the behavior of neural networks can cause the system to instability while the existence of impulsive effects, uncertain parameters, stochastic noises, Markovian jumps and time-delay factors (discrete delay, distributed delay, leakage delay & neutral delay). So, the consideration of the above facts can affect the stability of neural networks and it leads to be unstable, chaos or oscillation. The implementation of the stability (asymptotic, exponential, passivity and Lagrange sense) problem is handled by various classes of neural networks, that are Cohen-Grossberg BAM neural networks, stochastic neural networks, neutral-type NNs, Descriptor-type neural networks and inertial-type BAM neural networks.

Based on the Lyapunov-Krasovskii functional, Lyapunov stability theory, matrix inequality approaches, Ito calculus and integral inequality techniques, some novel stability criteria for neural networks is established in terms of linear matrix inequalities. Additionally, the feasibility of the obtained sufficient conditions are solved by the aid of LMI control toolbox in Matlab software. In order to, by utilizing free-weighting matrix techniques, different types of activation function conditions, some zero equations and transformation methods, the maximum allowable upper bounds of time-varying delays (i.e., discrete, distributed, neutral delays) are obtained. Also, some comparisons are listed with some existing literature which depicts its less conservativeness. To illustrate the superiority and effectiveness of analytical design of this thesis work, several examples with their numerical simulations are provided.