Summary and Conclusion

In **Chapter 1**, the author has discussed briefly about the notations, basic definitions, lemmas, and preliminary facts. Review of literature, objective of the study, methodologies used, thesis outline, organization and contribution has also been discussed.

In **Chapter 2**, several sufficient conditions guaranteeing the robust asymptotic stability problems for stochastic uncertain neural networks with discrete interval and distributed time-varying delays have been proposed. Some less conservative stability criteria have been obtained by considering the relationship between the time-varying delay and its lower and upper bounds when calculating the upper bound of the derivative of Lyapunov-Krasovskii functional. From the numerical comparisons, significant improvements over the recent existing results have been observed.

In **Chapter 3**, a new sufficient condition is derived to guarantee the global exponential stability of the equilibrium point for stochastic Cohen-Grossberg neural networks with multiple time-varying delays, which is different from the existing ones and has wider applications. The obtained result can be expressed in the form of linear matrix inequality and could be verified easily. Finally, a numerical example is provided to demonstrate the effectiveness of the main results described in this chapter. In future, it is possible to extend our main results for robust stability analysis for stochastic Cohen- Grossberg neural networks with unbounded time-varying delays.

In **Chapter 4**, new sufficient conditions guaranteeing the robust asymptotic stability (in the mean square sense) formarkovian jump stochastic neural networks with probability-distribution-dependent time-varying delays have been proposed. Based

on LMI methods, robust stability condition for the markovian jump stochastic neural networks have been obtained in the form of LMIs. Probability distribution of the time-varying delays is introduced into the stability criteria and the new method removes the constraint that the derivative of the delay must be smaller than 1. Finally, three numerical examples are demonstrated to prove less conservative results by comparison of numerical results in the existing literature.

In **Chapter 5**, the problem of stochastic stability analysis of Markovian jump neural networks with leakage time-varying delay, discrete and distributed time-varying delays is considered. The Markov process in the underlying neural networks is finite piecewise homogeneous. A leakage delay-dependent passivity conditions have been derived in terms of LMIs by constructing novel Lyapunov–Krasovskii functional having triple integral terms. This performance not only depends on the upper bound of the time-varying leakage delay $\sigma(t)$ but also it depends on the upper bound of the derivative of the time-varying leakage delay σ_μ. Two numerical examples have been provided to demonstrate the effectiveness of the proposed methods for both with and without Markovian jumping parameters.

In **Chapter 6**, passivity analysis of Markovian jumping neural networks of neutral type with time delays in the leakage term is considered. Delay-mode-dependent passivity conditions are derived by taking the inherent characteristic of such kinds of neural networks into account. An improved Lyapunov–Krasovskii functional (LKF) with the triple integral terms and quadruple integrals is constructed and the results are derived in terms of linear matrix inequalities. The information of the mode-dependent of all delays have been taken into account in the constructed Lyapunov–Krasovskii functional and derived novel stability criterion. Theoretical results are validated through numerical example.

The above study may be extended in future for various other types of neural networks under different time varying delays.

List of Publications

1. **N. Mala and A.R. Sudamani Ramaswamy,** *" Global exponential stability for stochastic Cohen-Grossberg neural networks with multiple time-varying delays "*, International Journal of Mathematical Modelling and Numerical Optimisation, Vol 4, No.4, 374- 386, 2014 .

2. **N. Mala and A.R. Sudamani Ramaswamy,** *" Passivity analysis of Markovian jumping neural networks with leakage time varying delays "*, Journal of Computational Methods in Physics, 013 (2013), Article ID 172906, 17 pages.

3. **N. Mala and A.R. Sudamani Ramaswamy,** *" LMI optimization approach to new stability results for uncertain stochastic neural networks with discrete interval and distributed time-varying delays "*, International Journal of Computing Science and Mathematics, in press.

4. **N. Mala and A.R. Sudamani Ramaswamy,** *" LMI conditions for delay-probability-distribution-dependent robust stability analysis of Markovian jump stochastic neural networks with time-varying delays "*, Communicated to Journal.

5. **N. Mala and A.R. Sudamani Ramaswamy,** *" Passivity analysis of Markovian Jumping neural networks of neutral type with time delays in the leakage term and mode-dependent delays "*, Communicated to Journal.