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DYNAMICS OF A BAM-TYPE NEURAL NETWORK SYSTEM WITH TIME DELAYS

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Abstract. This paper establishes three fundamental theoretical results for BAM-type neural networks with conformable derivative and constant delays. First, we derive sufficient conditions for the uniqueness of the equilibrium point through application of the contraction theorem. Then, employing an appropriate Lyapunov functional, the stability of the equilibrium is investigated, and exponential synchronization is achieved. Finally, an example is given to illustrate the validty of the results.

Keywords. BAM-type neural network, stability, synchronization, delay, conformable derivative.

AMS (MOS) subject classification: 34K20, 34K37, 93D20, 92B20.

1 Introduction

Over the past century, there have been remarkable advancements in neural network research, alongside significant progress in hardware technologies like CPUs, GPUs, capacitors, memristors, and optical systems. These technological breakthroughs have elevated the importance of neural networks in critical applications, including decision-making, optimization, pattern recognition, and the association of informational inputs. Pioneering work by McCulloch and Pitts [22] laid the foundation for this accelerated growth. Further contributions came from Hopfield [11, 12], whose model became instrumental in associative memory, optimization tasks, and computational problem solving. Another pivotal development was Kosko's introduction of bidirectional associative memory (BAM) neural networks [17, 18], which added to the growing efficiency and versatility of neural architectures. The network typically comprises two distinct neuron layers of equal size. While no connections exist between neurons within the same layer, each neuron fully integrates with all neurons in the opposing layer. This structure creates a bidirectional flow of information while preventing intra-layer communication, a characteristic