



**Thesis Title** Stability of Linear Discrete - Time Switched Systems with Delays

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## ABSTRACT

In this thesis, we study the stability and robust stability of two discrete-time linear switched systems with delays. The first system is given by

$$x_{k+1} = [A_{i_k} + \Delta A_{i_k}(k)]x_k + [B_{i_k} + \Delta B_{i_k}(k)]x_{k-h_{i_k}} \quad (1)$$

where  $k \in \mathbb{Z}^+$ ,  $h_{i_k} \in \mathbb{Z}^+$  are state delays,  $x_k \in \mathbb{R}^n$ ,  $i_k \in \{1, 2, \dots, N\}$  is a switching signal,  $A_{i_k}, B_{i_k} \in \mathbb{R}^{n \times n}$  are given constant matrices and  $\Delta A_{i_k}(k), \Delta B_{i_k}(k)$  are uncertain matrices which are assumed to be of the form

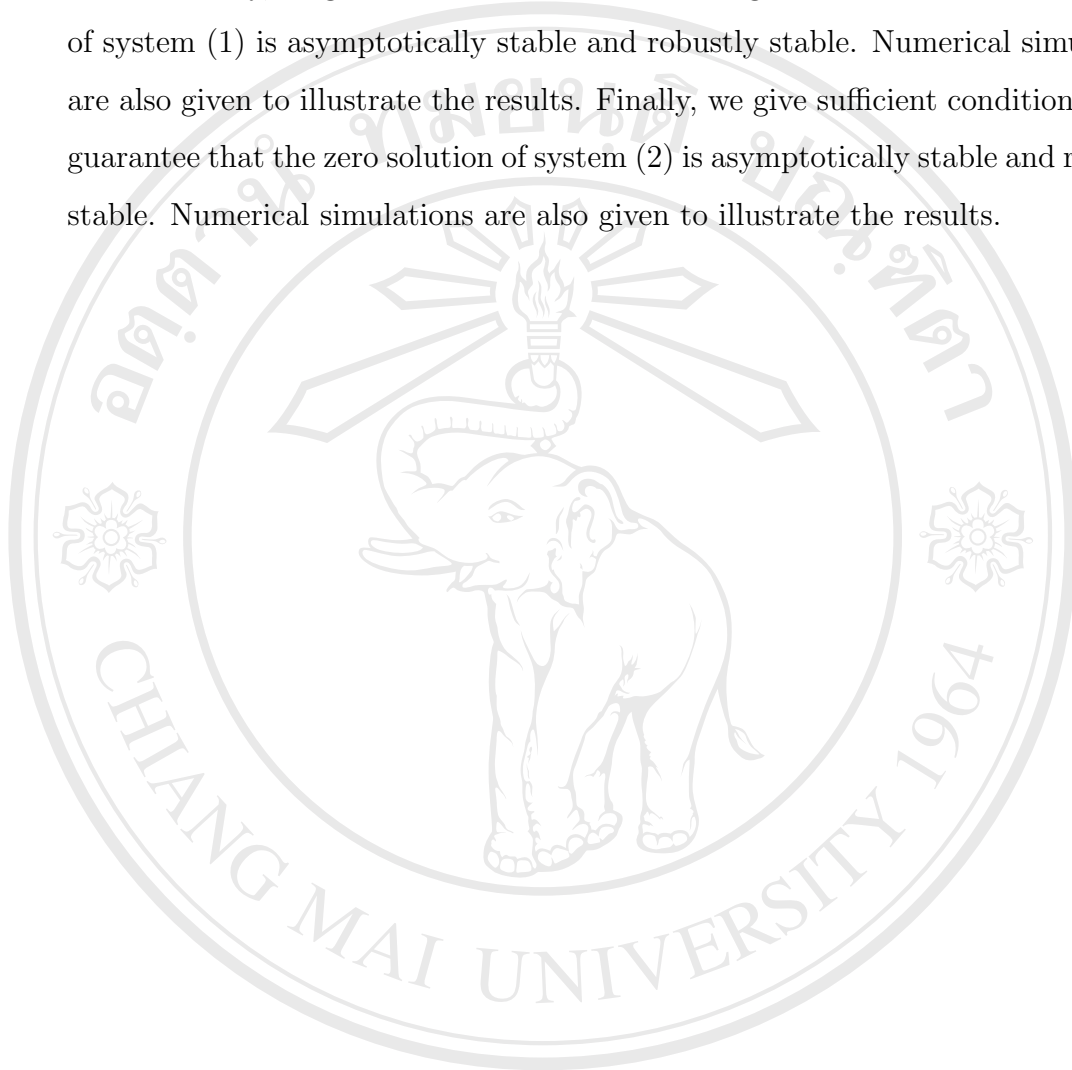
$$\begin{aligned} \Delta A_{i_k}(k) &= E_{i_k} F(k) F_{i_k} \\ \Delta B_{i_k}(k) &= H_{i_k} F(k) G_{i_k} \end{aligned}$$

where  $E_{i_k}, F_{i_k}, H_{i_k}, G_{i_k}$  are given constant matrices of appropriate dimensions and  $F(k)$  is a given matrix which  $F^T(k)F(k) \leq I$ . The second system is given by

$$x_{k+1} = [A_{i_k} + \Delta A_{i_k}(k)]x_k + [B_{i_k} + \Delta B_{i_k}(k)]x_{k-h_k} \quad (2)$$

where  $h_k$  are state delays satisfying  $0 < h_1 \leq h_k \leq h_2 < +\infty$ ,  $k \in \mathbb{Z}^+$ ,  $x_k \in \mathbb{R}^n$ ,  $A_{i_k}, B_{i_k} \in \mathbb{R}^{n \times n}$  are given constant matrices and  $\Delta A_{i_k}(k), \Delta B_{i_k}(k)$  are uncertain matrices which are given as in the first system.

Firstly, we give sufficient conditions which guarantee that the zero solution of system (1) is asymptotically stable and robustly stable. Numerical simulations are also given to illustrate the results. Finally, we give sufficient conditions which guarantee that the zero solution of system (2) is asymptotically stable and robustly stable. Numerical simulations are also given to illustrate the results.



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