Poincare Journal of Analysis & Applications
Vol. 8, No. 1(II) (2021), 53-68

AN EFFICIENT SYNCHRONIZATIONAL APPROACH TO THE STABILITY ANALYSIS OF MICROSCOPIC CHAOS GENERATED IN CHEMICAL REACTOR SYSTEM VIA ACTIVE AND ADAPTIVE CONTROL METHODS

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Date of Receiving	:	23. 03. 2021
Date of Revision	:	20. 06. 2021
Date of Acceptance	:	26. 06. 2021

Abstract. This study investigates the synchronization accomplishments of two broadly used chaos synchronization strategies: active control and adaptive control. It is demonstrated that the considered techniques have efficient performances in the synchronization of microscopic chaos generated in chemical reactor system (CRS) with the adaptive control method slightly outperforming the active control design in terms of transitory analysis. Nevertheless, the complexity of nonlinear adaptive control functions indicates that the active control would be more achievable in several engineering applications.

1. Introduction

Over the years, nonlinear chemical dynamics has progressed to be the most intriguing interdisciplinary field having enormous applications in all branches of chemistry, mathematics, biology, physics, engineering, and technology. During 1980 to 1995, macroscopic chaos is one of the illustrious phenomena found in several systems from laser optics [10] and fluid mechanics [6] to neurophysiology [9, 32] along with widely known Belousov-Zhabotinskii autocatalytic chemical reaction [38], the indium or gas-phase reactions [40] and the indium or thiocyanate electrochemical oscillator [22]. The aforesaid chaotic systems are indicated by high sensitivity to initial conditions which is prescribed as "Butterfly effect" in chaos literature. Fundamentally, this term is advocated by E.N. Lorenz [26] while studying a weather prediction model in 1963.

Microscopic chaos is specifically the irregularity or unpredictability of collisional motion of molecules and atoms presented in fluids. This existing chaos animated differential mesoscopic stochastic methods and reaction-diffusion development. These

2010 *Mathematics Subject Classification.* 34K23, 34K35, 37B25, 37N35.
Key words and phrases. Active control, Adaptive control, Chaotic system, Chemical reactor system, Complete synchronization, Lyapunov stability theory.
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Communicated by. Faisal Khan