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**Symmetric and Asymmetric Coupled Autocatalytic Reactions in an Isothermal CSTR**Aditya M. Kashyap<sup>1</sup>, Anand V.P. Gurumoorthy<sup>1</sup>, S. Pushpavanam<sup>2,\*</sup><sup>1</sup>*Department of Chemical Engineering, Vellore Institute of Technology, Vellore, 632 014, INDIA*<sup>2</sup>*Department of Chemical Engineering, Indian Institute of Technology Madras, Chennai, 600036, INDIA*

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**Abstract:**

Autocatalysis is the catalysis of a reaction by one of the products formed by the reaction. It serves as a possible mechanism for describing a self-replication process, in which the catalyst (reaction product) replicates itself using a substrate. Such processes occur across a wide spectrum of disciplines - ecology, economics, chemistry, biology and sociology. In this paper, we study a coupled system of two species, each undergoing an autocatalytic reaction in an isothermal CSTR. Each species participates in the autocatalysis of the other. Such systems arise in the inter-conversion of two optical isomers, enantiomers or social/religious groups. The two autocatalytic reactions are assumed to be elementary and follow either quadratic or cubic kinetics. Singularity theory and Bifurcation theory are applied to classify the steady state behaviour of the system. The focus of this work is to compare the dynamic behaviour of systems with symmetric and asymmetric kinetics. The analysis is aimed at obtaining conditions under which the formation of one of the species is maximized even when it is absent in the feed. Operating conditions for self-sustained oscillations of these systems are identified. Such systems also provide a mechanism or explanation for the prevalence of a particular isomer found in nature.

*Keywords: Autocatalytic Reactions, Bifurcation Theory, Singularity Theory, Species Interconversion*

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