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Geometric methods of global attraction in systems of delay differential equations

Hassan A. El-Morshedy [a], Alfonso Ruiz-Herrera [b,*]

[a] *Department of Mathematics, Faculty of Science, Damietta University, New Damietta 34517, Damietta, Egypt*
[b] *Departamento de Matemáticas, Universidad de Oviedo, Spain*

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Abstract

In this paper we deduce criteria of global attraction in systems of delay differential equations. Our methodology is new and consists in "dominating" the nonlinear terms of the system by a scalar function and then studying some dynamical properties of that function. One of the crucial benefits of our approach is that we obtain delay-dependent results of global attraction that cover the best delay-independent conditions. We apply our results in a gene regulatory model and the classical Nicholson's blowfly equation with patch structure.

Keywords: Dominance; Delay dependent criteria; Nicholson's blowfly equation; Global attraction

1. Introduction

Systems of delay differential equations, or more generally functional differential equations, have been extensively used as mathematical models for understanding medical treatments, the chemical patterns formation, ecological dynamics, cellular processes and control theory; see [1,2,10–12,16,21] and the references therein. Time delays are generally an inherent trait in a broad range of situations. For instance, they arise in population dynamics when the maturation period

* Corresponding author.
E-mail addresses: elmorshedy@yahoo.com (H.A. El-Morshedy), alfonsoruiz@dma.uvigo.es, ruizalfonso@uniovi.es (A. Ruiz-Herrera).

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