Available online at www.sciencedirect.com
ScienceDirect
Applied Mathematics and Computation 201 (2008) 811–818
APPLIED MATHEMATICS AND COMPUTATION
www.elsevier.com/locate/amc

Iterative scheme for the observation of a competitive Lotka–Volterra system

M. Gámez [a,*], I. López [a], Z. Varga [b]

[a] Department of Statistics and Applied Mathematics, University of Almería, Spain
[b] Institute of Mathematics and Informatics, Szent István University, Gödöllő, Hungary

Abstract

In this work, in terms of the model parameters, sufficient conditions are established to construct a sequence of approximate observers for a two-species competitive Lotka–Volterra system. This iterative approach makes it possible to localize the solution of the system, and reveal its long-term behaviour. The main results are also illustrated by numerical simulations.

Keywords: Iterative scheme; Local observer; Competitive Lotka–Volterra system

1. Introduction

As a classical description of a simple population system, the first continuous-time deterministic model of a predator–prey interaction was proposed by Lotka [8] and Volterra [13]. This model explained certain qualitative features of the behaviour of predator–prey systems that had been observed empirically (such as the periodic change of densities with a certain delay; or the increase and decrease in the time-mean density of predator and prey fish populations, respectively, due to harvesting activity). In [13] a first detailed stability analysis of a generalized n-species model was given for the basic classes of conservative and dissipative systems. Later on, the study was extended to non Lotka–Volterra type population systems. On the other hand, in a large number of papers, in-depth analysis of particular types Lotka–Volterra systems were given. For a collection of other classical works on the subject we refer the reader to [9]. For further references see e.g. [3,14].

In this work, the Lotka–Volterra model of two competing species will be considered. For some classical results on such systems see e.g. [3]. As a more recent development, in [11] an iterative scheme has been proposed for the study of competitive systems, see also [1,4,12]. Now we shall apply a similar iterative scheme for the construction and analysis of approximate observers for the monitoring of the state process in a two-species competitive system.

* Corresponding author.
E-mail addresses: mgamez@ual.es (M. Gámez), milopez@ual.es (I. López), Varga.Zoltan@gek.szie.hu (Z. Varga).

0096-3003/$ - see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.amc.2007.11.049