A Generalized 2-D Model for Fully Bounded Chaotic Attractors and Chaotic Seas

Zeraoulia Elhadj, Department of Mathematics, University of Tébessa, Tébessa, Algeria

ABSTRACT

The aim of this paper is to present a fully bounded 2-D model for chaotic attractors or chaotic seas. The relevance of this result is that there are some specific examples of bounded chaotic attractors or chaotic seas. There is no rigorous proof of this property for a general form of mappings.

Keywords: 2010 Mathematics Subject Classification 37E30, 2010 Mathematics Subject Classification 37E40, 2010 Mathematics Subject Classification 37E45, Chaotic Sea, Fully Bounded Map, Nonlinearities, Strange Attractor

INTRODUCTION

The most known dissipative chaotic attractors in the literature are unbounded for the almost values of their bifurcation parameters, i.e., these attractors are partially bounded in some narrow regions in the bifurcation parameters space (Zeraoulia & Sprott, 2011). Thus, the construction with a rigorous mathematical proof of a fully bounded dissipative chaotic attractor is a very important result. On the other hand, if a system is conservative, it does not have attractors nor basins of attraction (Strelcyn, 1991), but it does have a chaotic sea and elliptic islands. Precise definitions of elliptic islands and chaotic seas are difficult to give. Generally, a chaotic sea is constructed numerically just like a strange attractor with a well chosen range of initial conditions, i.e., initial conditions plays a crucial role in the formation of the corresponding chaotic sea. Any initial condition in this sea eventually visits every point in the sea just as with a strange attractor. Some examples of bounded chaotic seas can be found (Gorodetski, 2010; Liverani, 2004; Przytycki, 1982; Markarian, Oliffsonn Kamphorst, & Pinto de Carvalho, 1996; Jager, 2009, 2011; Turaev & Kedar, 1998; Devaney, 1984, 1992; Peitgen & Saupe, 1988), but there is no rigorous proof of them for specific cases. Some topological characterizations of elliptic islands in a chaotic sea are available (Markarian, Oliffsonn Kamphorst, & Pinto de Carvalho, 1996; Jager, 2009, 2011; Turaev & Kedar, 1998; Devaney, 1984).

In this paper, we will give a rigorous proof that any solution presented by a general form of 2-D mappings is fully bounded for some values of its bifurcation parameters and all initial conditions.
Artificial Immune Systems as a Bio-Inspired Optimization Technique and Its Engineering Applications


[www.igi-global.com/chapter/artificial-immune-systems-bio-inspired/19638?camid=4v1a](www.igi-global.com/chapter/artificial-immune-systems-bio-inspired/19638?camid=4v1a)