Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **18 (2011)** 601-614
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ATTRACTORS SYNTHESIS OF A CLASS OF NETWORKS

M.-F. Danca[1,2] and C. Morel[3]

[1]Department of Mathematics and Computer Science, Avram Iancu University
Str. Ilie Macelaru nr. 1A, 400380 Cluj-Napoca, Romania

[2]Romanian Institute of Science and Technology,
Str. Ciresilor nr. 29, 400487 Cluj-Napoca, Romania

[3]École Supérieure d'Électronique de l'Ouest – ESEO,
4, rue Merlet de la Boulaye 49009 Angers, France

Abstract. In this paper, we prove numerically and computationally that the attractors synthesis algorithm introduced in [1] for a class of dynamical systems can be applied for a class of networks too. While the underlying initial value problem is numerically integrated, if the control parameter is switched within a considered set of values, the obtained attractor will belong to the class of all attractors of the considered network. Moreover, this synthesized attractor coincides with the attractor obtained with the control parameter replaced with the averaged value of the switched values. The algorithm is applied here to a class of networks with the minimal dimension four, for which chaos still persists. In order to verify the accuracy of the results, the algorithm was run for random choices of the parameter values and their weights.

Keywords. global attractors, local attractors, numerical methods for ODEs, synthesized attractors.

1 Introduction

Next, we consider a class of nonlinear, continuous-time, dynamical systems, modeling a class of networks with the following autonomous Initial Value Problem (IVP), with a sigmoidal nonlinearity such as the hyperbolic tangent

$$\dot{x}_i = -px_i + \tanh \sum_{\substack{j=1 \\ j\neq i}}^{d} a_{ij}x_j, \quad x(0) = x_0, \quad t \in I = [0,T],\ T > 0, \tag{1}$$

where the system dimension d is some positive integer.

The IVP (1) can be written in the following symbolic vector form

$$\dot{x} = -px + \tanh\left(Ax\right),$$