Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Algorithms and Applications* **16 (2009)** 535-549
 http://www.watam.org

ASYMPTOTIC DYNAMICS OF THE SLOW-FAST HINDMARSH-ROSE NEURONAL SYSTEM

Nathalie Corson[1] and M.A. Aziz-Alaoui[1]

[1]Laboratoire de Mathématiques Appliquées du Havre
25 rue Philippe Lebon, 76600 Le Havre, France

Corresponding author email: nathalie.corson@univ-lehavre.fr

Abstract. This work adresses the asymptotic dynamics of a neuronal mathematical model. The aim is first the understanding of the biological meaning of existing mathematical systems concerning neurons such as Hodgkin-Huxley or Hindmarsh-Rose models. The local stability and the numerical asymptotic analysis of Hindmarsh-Rose model are then developed in order to comprehend bifurcations and dynamics evolution of a single Hindmarsh-Rose neuron. This has been performed using numerical tools borrowed from the nonlinear dynamical system theory.

Keywords. neuron model, asymptotic dynamics, bifurcation, chaos.

AMS (MOS) subject classification: 34C15, 37D45, 37G35, 37N25, 65P20, 92C20.

1 Introduction and neurophysiology

Also called *nerve cells*, *neurons* are the most important cells of the nervous system. They are composed of a cell body, or soma, extended by an axon, an axon terminal and some dendrites (Fig. 1). These extensions are useful not only for the transmission of information through a neuron but also for the transmission from a neuron to another. Connections between neurons are possible thanks to synapses.

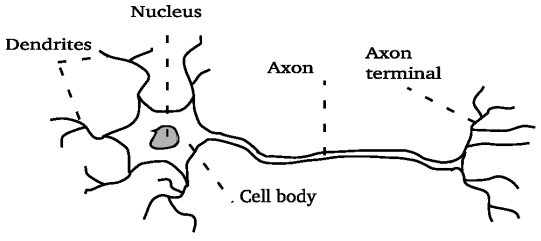

Figure 1: Structure of a typical neuron.