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A Note on Explicit Solutions of FitzHugh-Rinzel System

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Abstract: The numerous scientific feedbacks that the FitzHugh-Rinzel system (FHR) is having in various scientific fields, lead to further studies on the determination of its explicit solutions. Indeed, such a study can help to get a better understanding of several behaviours in the complex dynamics of biological systems. In this note, a class of travelling wave solutions is determined and specific solutions are achieved to explicitly show the contribution due to a diffusion term considered in the FHR model.

Keywords: *FitzHugh-Rinzel model; exact solutions; travelling wave solution.*

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1 Introduction

One of the most commonly known models in biomathematics is the FitzHugh-Rinzel (FHR) system [1–3]. It derives from the FitzHugh-Nagumo (FHN) model [4–12] and unlike the latter, it has an additional variable suitable for evaluating and studying nerve cell bursting phenomena.

In general, bursting oscillations can be described by a system variable that changes periodically from a rapid spike oscillation to a silent phase during which the membrane potential changes slowly [13].

Studies concerning bursting phenomena are increasingly present in various scientific fields (see, for instance, [14] and references therein), and in particular, some applications concern the restoration of synaptic connections. In fact, it seems that certain nanoscale memristor devices have the potential to reproduce the behaviour of a biological synapse,

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