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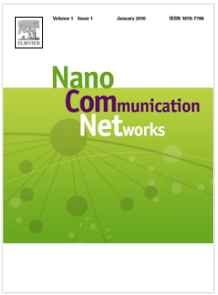

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A Queueing-Theoretical Delay Analysis for Intra-body Nervous Nanonetwork

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Abstract

Nanonetworks is an emerging field of study where nanomachines communicate to work beyond their individual limited processing capabilities and perform complicated tasks. The human body is an example of a very large nanoscale communication network, where individual constituents communicate by means of molecular nanonetworks. Amongst the various intra-body networks, the nervous system forms the largest and the most complex network. In this paper, we introduce a queueing theory based delay analysis model for neuro-spike communication between two neurons. Using standard queueing model blocks such as servers, queues and fork-join networks, impulse reception and processing through the nervous system is modeled as arrival and service processes in queues. Simulations show that the response time characteristics of the model are comparable to those of the biological neurons.

Keywords: Nanoscale communication, neuro-spike communication, intra-body nervous nanonetworks, queueing theory

1. Introduction

Applications of nanotechnology are being realized from nano-switches and actuators [1], to intelligent drug delivery [2], nanoscale sensing [3] and bio-hybrid systems [4]. Although the promise of nanotechnology is huge, the associated challenges are not small by any means either. Nanomachines face very small dimensions, scarce processing, limited memory resources and

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