SBML Model Report

Model name: "Izhikevich2003_SpikingNeuron"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by Enuo He[1] at July 16th 2007 at 9:41 a. m. and last time modified at February 14th 2014 at 11:28 a. m. Table 1 gives an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	0
events	2	constraints	0
reactions	0	function definitions	0
global parameters	8	unit definitions	2
rules	2	initial assignments	0

Model Notes

The model is according to the paper *Simple Model of Spiking Neurons* In this paper, a simple spiking model is presented that is as biologically plausible as the Hodgkin-Huxley model, yet as computationally efficient as the integrate-and-fire model. Known types of neurons correspond to different values of the parameters a,b,c,d in the model. Figure2RS,IB,CH,FS,LTS have been simulated by MathSBML.

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RS: a=0.02, b=0.2, c=-65, d=8.
IB: a=0.02,b=0.2,c=-55,d=4
CH: a=0.02,b=0.2,c=-50,d=2
FS:a=0.1b=0.2c=-65,d=2
LTS:a=0.02,b=0.25,c=-65,d=2

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2 Unit Definitions

This is an overview of six unit definitions of which four are predefined by SBML and not mentioned in the model.

2.1 Unit `time`

Name ms

Definition ms

2.2 Unit `mV`

Definition mV

2.3 Unit `substance`

Notes Mole is the predefined SBML unit for `substance`.

Definition mol

2.4 Unit `volume`

Notes Litre is the predefined SBML unit for `volume`.

Definition l

2.5 Unit area

Notes Square metre is the predefined SBML unit for area since SBML Level 2 Version 1.

Definition m^2

2.6 Unit length

Notes Metre is the predefined SBML unit for length since SBML Level 2 Version 1.

Definition m

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
cell			3	1	litre	☑	

3.1 Compartment cell

This is a three dimensional compartment with a constant size of one litre.

4 Parameters

This model contains eight global parameters.

Table 3: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
a			0.02		☑
b			0.20		☑
c			−65.00		☑
d			8.00		☑
Vthresh			30.00		☑
i			0.00		☐
v		0000259	−70.00		☐
U			−14.00		☐

5 Rules

This is an overview of two rules.

5.1 Rule v

Rule v is a rate rule for parameter v:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{v} = 0.04 \cdot \mathrm{v}^2 + 5 \cdot \mathrm{v} + 140 - \mathrm{U} + \mathrm{i} \tag{1}$$

5.2 Rule U

Rule U is a rate rule for parameter U:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{U} = \mathrm{a} \cdot (\mathrm{b} \cdot \mathrm{v} - \mathrm{U}) \tag{2}$$

6 Events

This is an overview of two events. Each event is initiated whenever its trigger condition switches from `false` to `true`. A delay function postpones the effects of an event to a later time point. At the time of execution, an event can assign values to species, parameters or compartments if these are not set to constant.

6.1 Event event_0000001

Trigger condition

$$\mathrm{v} > \mathrm{Vthresh} \tag{3}$$

Assignments

$$\mathrm{v} = \mathrm{c} \tag{4}$$

$$\mathrm{U} = \mathrm{U} + \mathrm{d} \tag{5}$$

6.2 Event event_0000002

Name Stimulus

Trigger condition

$$\mathrm{time} > 10 \tag{6}$$

Assignment

$$\mathrm{i} = 10 \tag{7}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000259 voltage: Difference of electrical potential between two points of an electrical network, expressed in volts

SBML2LaTeX was developed by Andreas Dräger[a], Hannes Planatscher[a], Dieudonné M Wouamba[a], Adrian Schröder[a], Michael Hucka[b], Lukas Endler[c], Martin Golebiewski[d] and Andreas Zell[a]. Please see http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX for more information.

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