SBML Model Report

Model name: "Izhikevich2004-_SpikingNeurons_Class2Excitable"

May 5, 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 25th 2015 at 11:19 a. m. Table 1 provides 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	1	constraints	0
reactions	0	function definitions	0
global parameters	8	unit definitions	0
rules	3	initial assignments	0

Model Notes

This a model from the article:
Which model to use for cortical spiking neurons?
Izhikevich EM. IEEE Trans Neural Netw.2004 Sep;15(5):1063-70. 15484883,
Abstract:
We discuss the biological plausibility and computational efficiency of some of the most useful

[1] BNMC, enuo@caltech.edu

models of spiking and bursting neurons. We compare their applicability to large-scale simulations of cortical neural networks.

The model is according to the paper*Which Model to Use for Cortical Spiking Neurons?* Figure1(H) Class 2 excitable has been reproduced by MathSBML. The ODE and the parameters values are taken from the a paper *Simple Model of Spiking Neurons*The original format of the models are encoded in the MATLAB format existed in the ModelDB with Accession number 39948

Figure1 are the simulation results of the same model with different choices of parameters and different stimulus function or events.a=0.2; b=0.26; c=-65; d=0; V=-64; u=b*V;

2 Unit Definitions

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

2.1 Unit `substance`

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

Definition mol

2.2 Unit `volume`

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

Definition l

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit time

Notes Second is the predefined SBML unit for time.

Definition s

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			0.20		☑
b			0.26		☑
c			−65.00		☑
d			0.00		☑
Vthresh			30.00		☑
i			−0.50		☐
v			−64.00		☐
u			−16.64		☐

5 Rules

This is an overview of three rules.

5.1 Rule `i`

Rule `i` is an assignment rule for parameter `i`:

$$\mathrm{i} = \begin{cases} 0 & \text{if time} < 30 \\ -0.5 + 0.015 \cdot (\text{time} - 30) & \text{otherwise} \end{cases} \tag{1}$$

5.2 Rule `v`

Rule `v` is a rate rule for parameter `v`:

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

5.3 Rule `u`

Rule `u` is a rate rule for parameter `u`:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{u} = \mathrm{a} \cdot (\mathrm{b} \cdot \mathrm{v} - \mathrm{u}) \tag{3}$$

6 Event

This is an overview of one event. 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

$$\mathrm{v} > \mathrm{Vthresh} \tag{4}$$

Assignments

$$\mathrm{v} = \mathrm{c} \tag{5}$$

$$\mathrm{u} = \mathrm{u} + \mathrm{d} \tag{6}$$

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.

[a]Center for Bioinformatics Tübingen (ZBIT), Germany
[b]California Institute of Technology, Beckman Institute BNMC, Pasadena, United States
[c]European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, United Kingdom
[d]EML Research gGmbH, Heidelberg, Germany