Command: aeif_cond_exp

Name:

Membrane aeif_cond_exp - Conductance based exponential integrate-and-fire neuron model according to Brette and Gerstner (2005).

Description:

aeif_cond_exp is the adaptive exponential integrate and fire neuron according to Brette and Gerstner (2005), with post-synaptic conductances in the form of truncated exponentials.

This implementation uses the embedded 4th order Runge-Kutta-Fehlberg solver with adaptive stepsize to integrate the differential equation.

The membrane potential is given by the following differential equation:
$C\ dV/dt= -g\_L(V-E\_L)+g\_L*Delta\_T*exp((V-V\_T)/Delta\_T)-g\_e(t)(V-E\_e)\ -g\_i(t)(V-E\_i)-w\ +I\_e$

and

$tau\_w * dw/dt= a(V-E\_L)\ -W$

Note that the spike detection threshold V_peak is automatically set to V_th+10 mV to avoid numerical instabilites that may result from setting V_peak too high.

Parameters: The following parameters can be set in the status dictionary.

Dynamic state variables:
```
  V_m         double - Membrane potential in mV
  g_ex        double - Excitatory synaptic conductance in nS.
  g_in        double - Inhibitory synaptic conductance in nS.
  w           double - Spike-adaptation current in pA.
```

Parameters:
```
  C_m         double - Capacity of the membrane in pF
  t_ref       double - Duration of refractory period in ms.
  V_reset     double - Reset value for V_m after a spike. In mV.
  E_L         double - Leak reversal potential in mV.
  g_L         double - Leak conductance in nS.
  I_e         double - Constant external input current in pA.

Spike adaptation parameters:
  a           double - Subthreshold adaptation in nS.
  b           double - Spike-triggered adaptation in pA.
  Delta_T     double - Slope factor in mV
  tau_w       double - Adaptation time constant in ms
  V_t         double - Spike initiation threshold in mV
  V_peak      double - Spike detection threshold in mV.

Synaptic parameters
  E_ex        double - Excitatory reversal potential in mV.
  tau_syn_ex double - Rise time of excitatory synaptic conductance in ms (exp function).
  E_in        double - Inhibitory reversal potential in mV.
  tau_syn_in double - Rise time of the inhibitory synaptic conductance in ms (exp function).

Integration parameters
  gsl_error_tol  double - This parameter controls the admissible error of the GSL integrator.
                          Reduce it if NEST complains about numerical instabilities.
```

Author: Adapted from aeif_cond_alpha by Lyle Muller

Sends: SpikeEvent

Receives: SpikeEvent, CurrentEvent, DataLoggingRequest

Brette R and Gerstner W (2005) Adaptive Exponential Integrate-and-Fire Model as

References: Brette R and Gerstner W (2005) Adaptive Exponential Integrate-and-Fire Model as
                       an Effective Description of Neuronal Activity. J Neurophysiol 94:3637-3642

SeeAlso: iaf_cond_exp aeif_cond_alpha

Source: /home/jgornet/Documents/nest-2.10.0/models/aeif_cond_exp.h

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