

1 “environment” component

This component has no equations.

2 “membrane” component

membrane_voltage_diff_eq

$$\frac{d(V)}{d(time)} = \frac{-((i_K + i_{K_Ca} + i_{K_ATP} + i_{Ca_f} + i_{Ca_s} + i_{CRAC}))}{C_m}$$

3 “delayed_rectifier_K_channel_current” component

i_K_calculation

$$i_K = g_K * n * (V - V_K)$$

4 “delayed_rectifier_K_channel_current_n_gate” component

n_diff_eq

$$\frac{d(n)}{d(time)} = \frac{(n_infinity - n)}{\tau_n}$$

n_infinity_calculation

$$n_infinity = \frac{1.0}{\left(1.0 + e^{\frac{(V_n - V)}{S_n}}\right)}$$

tau_n_calculation

$$\tau_n = \frac{4.86}{\left(1.0 + e^{\frac{(V + 15.0)}{6.0}}\right)}$$

5 “K_ATP_channel_current” component

i_K_ATP_calculation

$$i_{K_ATP} = g_{K_ATP} * (V - V_K)$$

6 “fast_Ca_channel_current” component

i_Ca_f_calculation

$$i_{Ca_f} = g_{Ca_f} * m_f_infinity * (V - V_{Ca})$$

7 “fast_Ca_channel_current_m_f_gate” component

fast_Ca_channel_current_m_f_gate_infinity_calculation

$$m_f_infinity = \frac{1.0}{\left(1.0 + e^{\frac{(V_{m_f} - V)}{S_{m_f}}}\right)}$$

8 “slow_Ca_channel_current” component

i_Ca_s_calculation

$$i_{Ca_s} = g_{Ca_s} * j * m_s_infinity * (V - V_{Ca})$$

9 “slow_Ca_channel_current_m_s_gate” component

m_s_infinity_calculation

$$m_s_infinity = \frac{1.0}{\left(1.0 + e^{\frac{(V_{m_s} - V)}{S_{m_s}}}\right)}$$

10 “slow_Ca_channel_current_j_gate” component

j_diff_eq

$$\frac{d(j)}{d(time)} = \frac{(j_infinity - j)}{tau_j}$$

j_infinity_calculation

$$j_infinity = \frac{1.0}{\left(1.0 + e^{\frac{(V_j - V)}{S_j}}\right)}$$

tau_j_calculation

$$\tau_j = \frac{50000.0}{\left(e^{\frac{(V+53.0)}{4.0}} + e^{\frac{-((V+53.0))}{4.0}} + 1500.0 \right)}$$

11 “Ca_activated_K_current” component

i_K_Ca_calculation

$$i_{K_Ca} = g_{K_Ca} * \frac{(Ca_i)^{5.0}}{\left((Ca_i)^{5.0} + (0.55)^{5.0} \right)} * (V - V_K)$$

12 “CRAC_current” component

i_CRAC_calculation

$$i_{CRAC} = g_{CRAC} * r_{infinity} * Ca_{er} * (V - V_{CRAC})$$

13 “CRAC_current_r_gate” component

CRAC_current_r_gate_infinity_calculation

$$r_{infinity} = \frac{1.0}{(1.0 + e^{(Ca_{er}-3.0)})}$$

14 “calcium_handling_equations” component

Ca_i_diff_eq

$$\frac{d(Ca_i)}{d(time)} = \left(\frac{1.0}{lamda} * \left(\left(\frac{P_{leak}}{P_{ip3}} + O_{infinity} \right) * (Ca_{er} - Ca_i) - \frac{J_{er}}{P_{ip3}} \right) + \frac{J_{mem}}{Vi_{eff}} \right)$$

Ca_er_diff_eq

$$\frac{d(Ca_{er})}{d(time)} = -\left(\frac{1.0}{lamda * sigma} \right) * \left(\left(\frac{P_{leak}}{P_{ip3}} + O_{infinity} \right) * (Ca_{er} - Ca_i) - \frac{J_{er}}{P_{ip3}} \right)$$

Vi_eff_calculation

$$Vi_{eff} = \frac{Vi}{fi}$$

Ver_eff_calculation

$$Ver_{eff} = \frac{Ver}{fer}$$

lamda_calculation

$$lamda = \frac{Vi_eff}{P_ip3}$$

sigma_calculation

$$sigma = \frac{Ver_eff}{Vi_eff}$$

O_infinity_calculation

$$O_infinity = a_infinity * b_infinity * h_infinity$$

a_infinity_calculation

$$a_infinity = \frac{Ca_i}{(Ca_i + 0.1)}$$

b_infinity_calculation

$$b_infinity = \frac{IP3}{(IP3 + 0.2)}$$

h_infinity_calculation

$$h_infinity = \frac{0.4}{(Ca_i + 0.4)}$$

J_er_p_calculation

$$J_er_p = P_ip3 * Ver_p * \frac{(Ca_i)^{2.0}}{((Ca_i)^{2.0} + (0.09)^{2.0})}$$

15 “calcium_flux_through_the_plasma_membrane” component

J_mem_calculation

$$J_mem = (-(alpha) * (i_Ca_s + i_Ca_f) - K_Ca * Ca_i)$$

16 “calcium_flux_through_the_ER_membrane” component

J_er_calculation

$$J_er = ((P_leak + P_ip3 * O_infinity) * (Ca_er - Ca_i) - J_er_p)$$