Mathematical and Computer Modeling of Biological Processes

Practice 8

Consider the FitzHugh-Nagumo model of neuronal oscillations:

$$\begin{aligned} \frac{dv}{dt} &= -v(v-a)(v-1)-w+I, \\ \frac{dw}{dt} &= \varepsilon(v-\gamma w), \end{aligned} \tag{8.1}$$

where v is the voltage of the action potential, w is a variable acting to diminish v, i.e. a channel blocking mechanism, I is the applied current coming from the soma, ε is a small parameter, and γ is a positive constant.

Initial conditions for (v, w) are given by

1) $(0.4, 0)$;
2) $(0.5, 0)$; (8.2)
3) $(0.6, 0)$.

Tasks

1. Solve model (8.1) with three initial conditions (8.2) at $a = 0.3$, $\varepsilon = 0.001$, $\gamma = 2.5$, and $I = 0$.
2. Draw the graphs for
   a) v versus $\frac{dv}{dt}$;
   b) $v(t)$ and $w(t)$ versus time t.

(3 points)