# Introdução à Neurociência Computacional
# Lista de Exercícios 8

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Todos os códigos escritos para produzir os resultados dos exercícios a seguir estão disponibilizados de forma clara e organizada no repositório Github:

https://github.com/prsturion/intro-computational-neuroscience.git

**Questão 1:**
**(a)**

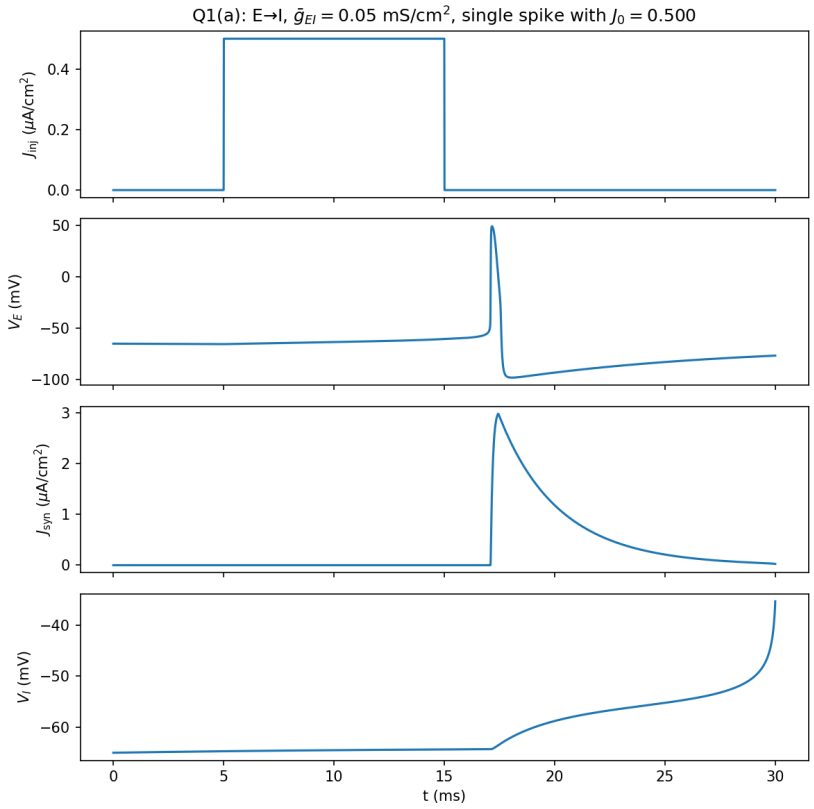


Figura 1: Simulação do modelo de neurônios acoplados da Questão 1.

**(b)**

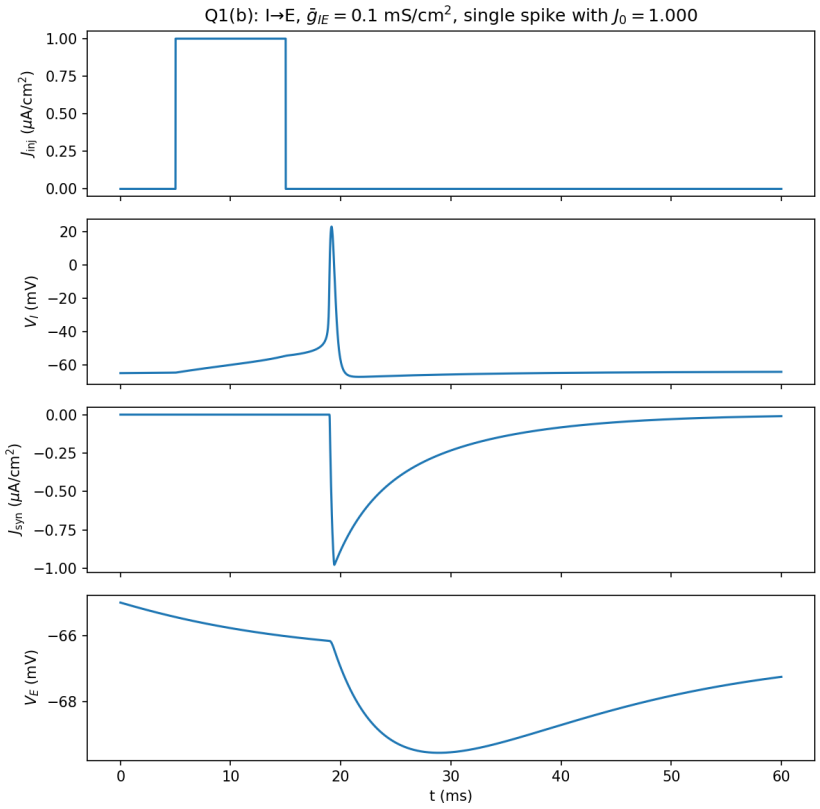


Figura 2: Simulação do modelo de neurônios acoplados da Questão 1 com a inversão de papeis pedida no item (b).

**(c)**

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Estimated interspike interval of E with J0=1.5 μA/cm²: T ≈ 17.657 ms (mean ISI from 26 spikes).

Results for g_EI (mS/cm²): spikes in I and whether it forms a train (>=3 spikes).
  g_EI=0.10 -> I spikes:  20  -> train? YES
  g_EI=0.12 -> I spikes:  20  -> train? YES
  g_EI=0.14 -> I spikes:  19  -> train? YES
  g_EI=0.16 -> I spikes:  22  -> train? YES
  g_EI=0.18 -> I spikes:  26  -> train? YES
  g_EI=0.20 -> I spikes:  29  -> train? YES
  g_EI=0.22 -> I spikes:  32  -> train? YES
  g_EI=0.24 -> I spikes:  38  -> train? YES
  g_EI=0.26 -> I spikes:  38  -> train? YES
  g_EI=0.28 -> I spikes:  38  -> train? YES

Values of g_EI for which I emits a spike train: [0.1, 0.12, 0.14, 0.16, 0.18, 0.2, 0.22, 0.24, 0.26, 0.28]
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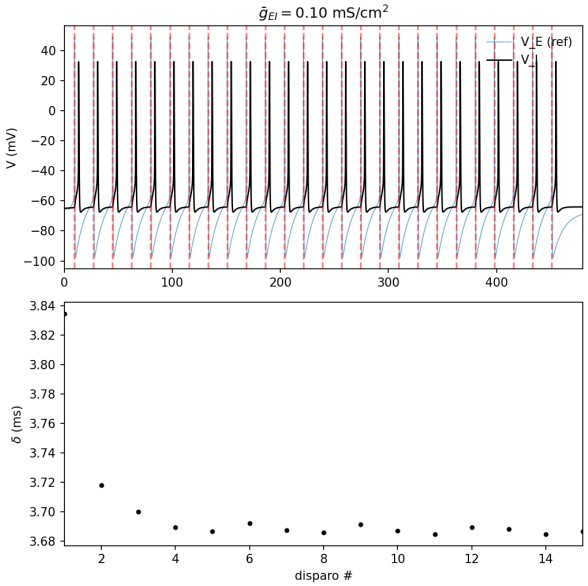
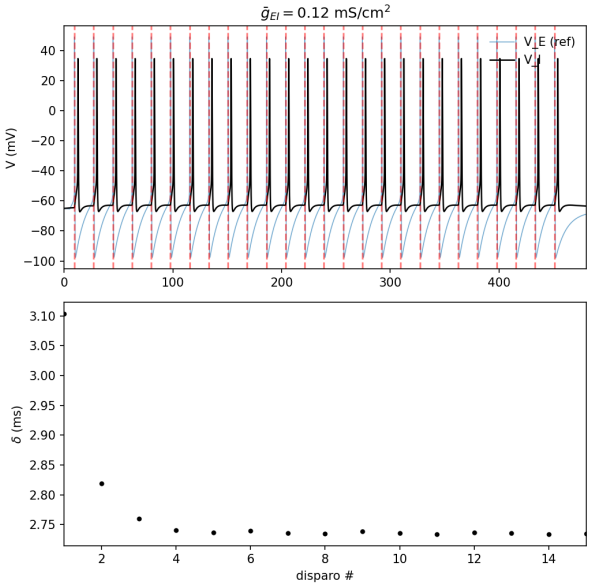
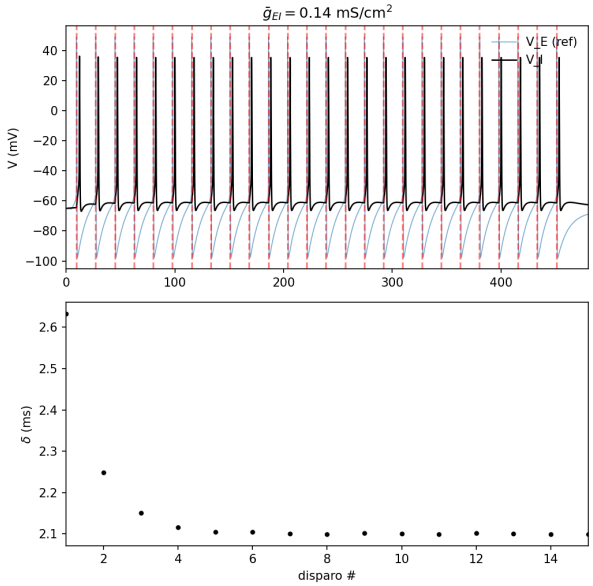
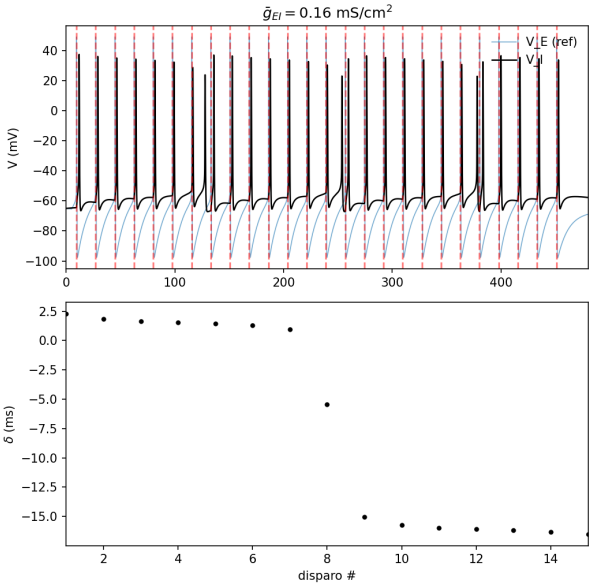
Figura 3: Resultados do item (c).

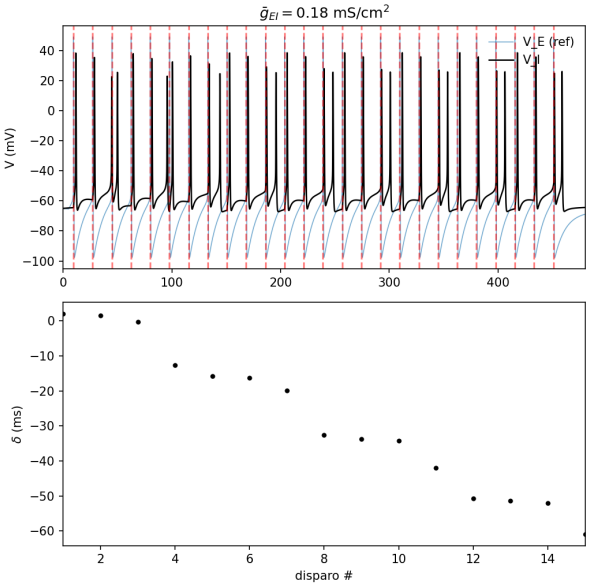
**(d)**

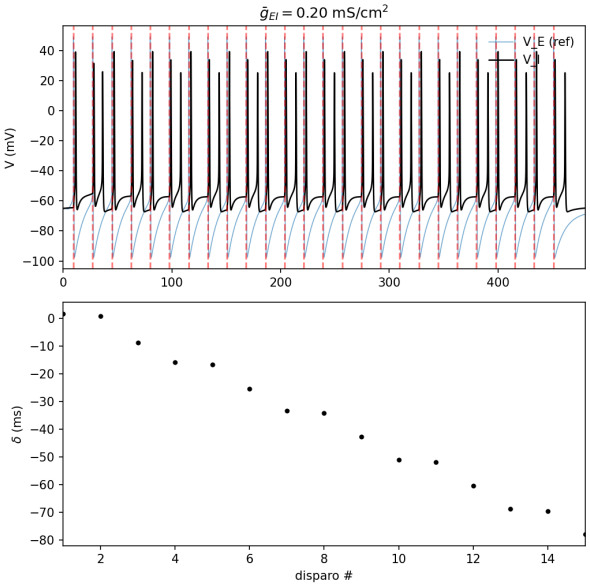

$\bar{g}_{El} = 0.10$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #

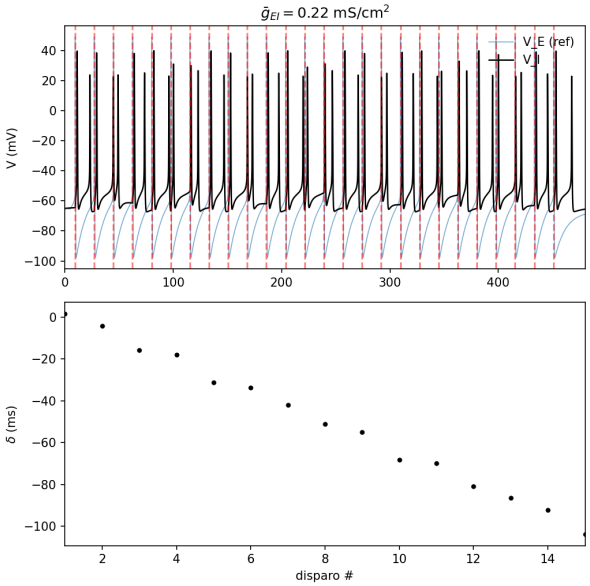

$\bar{g}_{El} = 0.12$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #

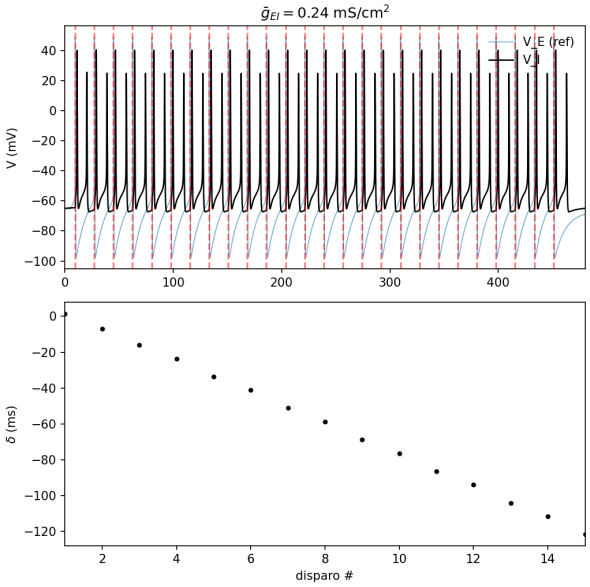

$\bar{g}_{EI} = 0.14$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #


$\bar{g}_{EI} = 0.16$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #


$\bar{g}_{EI} = 0.18$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #


$\bar{g}_{EI} = 0.20$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #


$\bar{g}_{El} = 0.22$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #


$\bar{g}_{El} = 0.24$ mS/cm$^2$
V_E (ref)
V_I
V (mV)
δ (ms)
disparo #

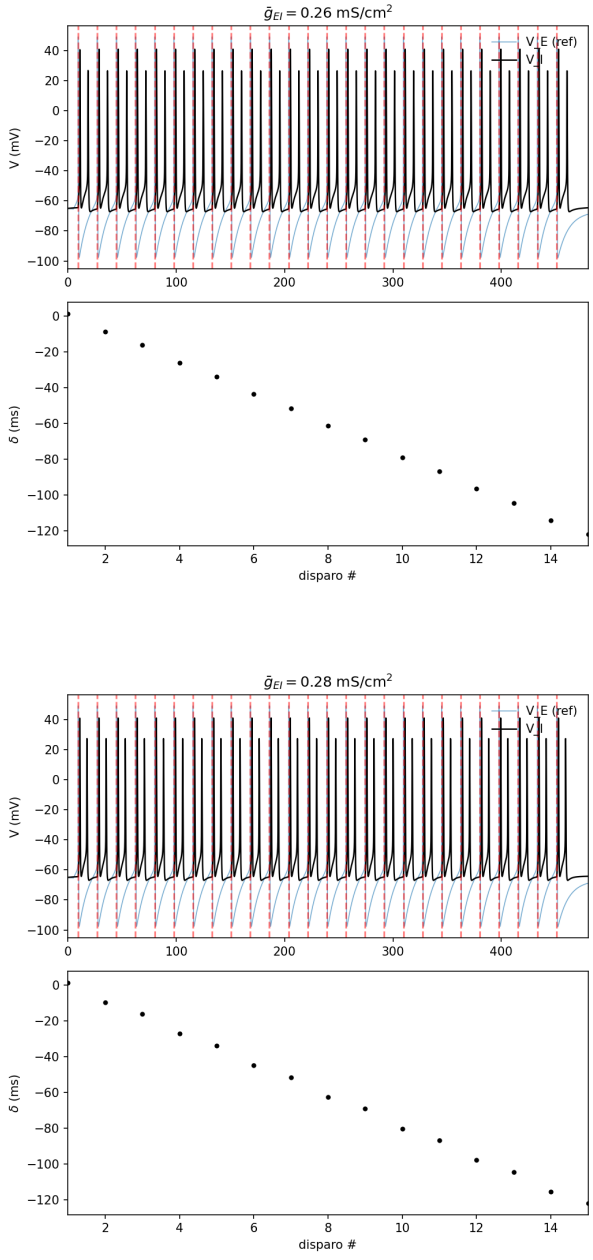



Figura 4: Gráficos dos disparos e da fase para os diferentes valores de $\bar{g}_{EI}$.

Ao varrer $\bar{g}_{EI} \in \{0{,}10, 0{,}12, 0{,}14, 0{,}16, 0{,}18, 0{,}20, 0{,}22, 0{,}24, 0{,}26, 0{,}28\}$ mS/cm$^2$, observou-se:

- **Sincronização** 1:1 **com travamento de fase:** para $\bar{g}_{EI} = \{0{,}10,\ 0{,}12,\ 0{,}14\}$ mS/cm$^2$, o neurônio I dispara um pico para cada pico de E, com atraso aproximadamente constante $\delta \simeq 3{,}8 \rightarrow 2{,}1$ ms ao longo dos disparos.

- **Acima de $\bar{g}_{EI} \geq 0{,}16$ mS/cm$^2$:** não há travamento de fase; o atraso $\delta$ varia sistematicamente (inclusive tornando-se negativo), caracterizando perda de sincronização 1:1.
- **Sincronização $n$:1:** não foi observada para nenhum dos valores testados (isto é, não houve $n$:1 com $n \geq 2$).