ת.ז 204025258
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ניקות אותות · תרגיל 1

1) I've charted a figure for each of the subjects. (see figure 1)
we can see that all of them with no exception are stationary.:

a- avg of 1.006 with std 0.031
the auto correlation is low (0.05) and due to these data -> yes.

b- avg " 1.497 " 0.06
autocorr " 0.06 ->yes

c- avg " 2.006 " 0.074
autocorr 0.01 -> yes

This is the most noisy data, relative to a,b but the low autocorr suggest no correlation between (X_t, X_{t+1}).

2) a- avg fire rate 0.028 sp/sec (see figure 2, first one)

b- See figure 2 (second one). The longer the window, the less resolution we have and thus, less accurate.

c- See figure 2 (third). Numpy offers a more accurate approximation.

d- See figure 2 (fourth). Same as b- for bigger win less accurate.

e- See figure 2 (Fifth).

Higher std allows a smoother curve. it affects more significant then increased window size. i.e. both parameters are tools to approximate the neuron fire rate, in direct effect. Higher std / window size presents a simple picture than using lower ones.

Summary

No Free Lunch! =)

We saw that smaller window convolution provides a more accurate curve, but in cost of smoothness.

3)

$X(t) = e^{\alpha t} \cdot u(t) \quad h(t) = e^{-\alpha t} u(-t) \quad u(t) = \begin{cases} 1 & t \le 0 \\ 0 & \text{else} \end{cases} \quad \alpha > 0$

$z(t) = X(t) \underset{\text{conv}}{\otimes} h(t) = \int_{-\infty}^{\infty} \underbrace{X(\tau)}_{\mathrm{I}} \cdot \underbrace{h(t-\tau)}_{\mathrm{II}} d\tau = \int_{-1}^{t} z(t) + \int_{t}^{1} z(t) =$

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$\mathrm{I}: X(\tau) = e^{\alpha \tau} \cdot u(\tau)$

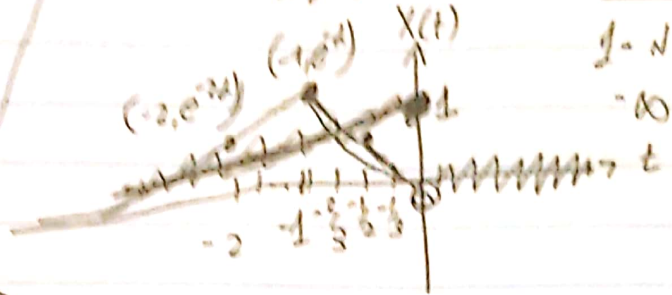
$\mathrm{II}: h(t-\tau) = e^{-\alpha(t-\tau)} \cdot u(-(t-\tau)) = e^{-\alpha(t-\tau)} \cdot u(\tau - t)$

$x(t) = e^{\alpha t} u(t)$

$u(t) = \begin{cases} 1 & t\geq 0 \\ 0 & 0 \end{cases}$

$x(t) = \begin{cases} e^{\alpha t} & t\leq 0 \\ 0 & t>0 \end{cases}$

הסקלים: ①

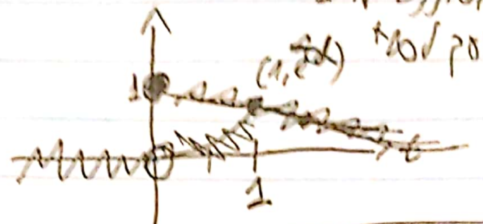


אקספוננט ג-1
קודם ל ∞-

$h(t) = e^{-\alpha t} u(-t)$

$h(t) = \begin{cases} 0 & t<0 \\ e^{\alpha t} & t\geq 0 \end{cases}$

ואקספוננט ג-1
קודם לאפס

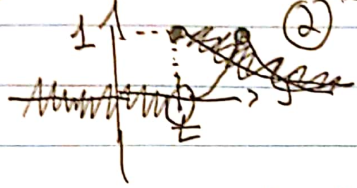


$z(t) = \int_{-\infty}^{\infty} x(\tau)\cdot h(\tau - t)\, d\tau =$

$h(t-\tau) = e^{-\alpha(t-\tau)} u(-(t-\tau))$

$h(t-\tau) = e^{\alpha(\tau - t)} u(\tau - t)$

$\underbrace{\int_{t}^{0} h(t)\, d\tau}_{\text{II}} + \underbrace{\int_{-\infty}^{0} x(\tau)\, d\tau}_{\text{I}}$



הישקיף

$e^{\alpha(t-\tau)} \Big|_{0}^{\infty} + e^{\alpha(\tau - t)} \Big|_{t}^{\infty}$

$1 - e^{\alpha t} + e^{\alpha(1-t)} - e = e^{\alpha - \alpha t} - e^{\alpha t} = e^{\alpha} \cdot$ //