

# First passage time distribution for spiking neuron with fast inhibitory feedback stimulated with renewal stream

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We consider a class of spiking neuron models defined by a set of conditions typical for basic threshold-type models, such as leaky integrate-and-fire model and some artificial neurons. A series of impulses, representing a point renewal process, is applied to a neuron. Each output impulse is fed back to the neuron after a fixed time delay,  $\Delta$ . This impulse acts as an impulse received through a fast inhibitory (GABA<sub>A</sub>) synapse.

In our previous work [1], we have obtained a general relation in case of input Poisson stream for calculating exactly the probability density function (PDF)  $p(t)$  for the distribution of the first passage time of crossing the threshold.

In the present work, we have obtained a similar results but applicable in case of any renewal input stream. The calculation is based on the known PDF  $p^0(t)$  for the same neuron without feedback and the PDF of interspike intervals for input stream,  $p^{in}(t)$ .

[1]. Vidybida, A., Shchur, O. Relation between firing statistics of spiking neuron with delayed fast inhibitory feedback and without feedback, *Fluctuation and Noise Letters*, 17(01):1850005 (2018).

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