

## Relation between firing statistics of spiking neuron with delayed feedback and without feedback

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We consider a class of spiking neuronal models with threshold 2, defined by a set of conditions typical for basic threshold-type models, such as the leaky integrate-and-fire or the binding neuron model and also for some artificial neurons. A neuron is fed with a Poisson process. Each output impulse is applied to the neuron itself after a finite delay  $\Delta$ . This impulse is identical to those delivered from the input stream. We derive a general relation which allows calculating exactly the probability density function (pdf)  $p(t)$  of output interspike intervals of a neuron with feedback based on known pdf  $p^0(t)$  for the same neuron without feedback, intensity of the input stream and the properties of the feedback line (the  $\Delta$  value).

In addition to this, we calculate exactly the model-independent initial segment of pdf  $p(t)$  for a neuron with feedback that is the same for any neuron satisfying the imposed conditions. Also, relations between moments of pdf  $p(t)$  for a neuron with feedback and pdf  $p^0(t)$  for the same neuron without feedback are derived. The obtained expressions are checked numerically by means of Monte Carlo simulation.

The course of  $p(t)$  has a  $\delta$ -function peculiarity, which makes it impossible to approximate  $p(t)$  by Poisson or another simple stochastic process.

**Primary authors:** SHCHUR, Olha (Bogolyubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine); Dr VIDYBIDA, Alexander (Bogolyubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine)

**Presenter:** SHCHUR, Olha (Bogolyubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine)

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