

Waiting-time densities of resonate and fire neurons

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The response of a neural cell to an external stimulus can follow one of the two patterns: Non-resonant neurons monotonously relax to the resting state while resonant ones show subthreshold oscillations after excitation. We investigate how do these subthreshold behaviour affect their suprathreshold response.

The dynamics of neurons is given by stochastic FitzHugh-Nagumo and Morris Lecar models with either having a focus or a node as the stable fixpoint. We determine numerically the spectral power density as well as the multipeaked interspike interval density in response to a random (white and colored noise) inputs.

For the latter we find analytic expression from the consideration of linear approximations with threshold, reset condition and in presence of noise. We compare first, second and n-th order approximations with numerical simulations.

We show that the interspike interval densities is a very sensitive instrument for the diagnostics of whether the dynamics has resonant or noresonant properties. In contrast, the consideration of spectra is insufficient to distinct between the two neuronal types.

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