
On FitzHugh-Nagumo SDEs and SPDEs

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Abstract

We will discuss two results on stochastic FitzHugh-Nagumo equations arising in neuroscience. The first result concerns the interspike interval distribution in FitzHugh-Nagumo SDEs for a single neuron in the excitable regime. We prove that in a large parameter range, this distribution is asymptotically exponential, with a parameter which can be expressed in terms of the principal eigenvalue of a substochastic Markov chain. The second result is on local existence of solutions for FitzHugh-Nagumo SPDEs in two and three space dimensions for a large population of neurons. The proof relies on Martin Hairer's theory of regularity structures, and requires the equation to be renormalised.

References:

Nils Berglund and Damien Landon, Mixed-mode oscillations and interspike interval statistics in the stochastic FitzHugh-Nagumo model, *Nonlinearity* 25:2303-2335 (2012)
Nils Berglund and Christian Kuehn, Regularity structures and renormalisation of FitzHugh-Nagumo SPDEs in three space dimensions, preprint arXiv:1504.02953 (2015)

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