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Modelling spike frequency adaptation through higher-order fractional leaky integrate and fire model

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Spike frequency adaptation is a key characteristic of spiking neurons [1]. To examine this form of adaptation, we introduce a higher-order fractional leaky integrate and fire model. In this model, the exponent of the fractional derivative can range between one (representing an ordinary first order derivative) and two. In this regime, the impact of the past membrane potential on the present potential is inhibitory leading to spike frequency adaptation. We also analyze spike frequency adaptation in response to noisy input current and show that spike frequency adaptation is reinforced as the intensity of noisy input increases.

Keywords: spike frequency adaptation, neuron, fractional differential equation

References

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