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Coombes, S.; **Timofeeva, Y.**; **Svensson, C.-M.**; **Lord, G. J.**; **Josić, K.**; **Cox, S. J.**; **Colbert, C. M.**

Branching dendrites with resonant membrane: a "sum-over-trips" approach. (English)

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Summary: Dendrites form the major components of neurons. They are complex branching structures that receive and process thousands of synaptic inputs from other neurons. It is well known that dendritic morphology plays an important role in the function of dendrites. Another important contribution to the response characteristics of a single neuron comes from the intrinsic resonant properties of dendritic membranes. We combine the effects of dendritic branching and resonant membrane dynamics by generalising the "sum-over-trips" approach [*L. F. Abbott* et al. ibid. 66, 49–60 (1991; Zbl 0743.92010)]. To illustrate how this formalism can shed light on the role of the architecture and resonances in determining neuronal output we consider dual recording and reconstruction data from a rat CA1 hippocampal pyramidal cell. Specifically we explore the way in which an I_h current contributes to a voltage overshoot at the soma.

MSC:

92C20 Neural biology

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Keywords:

quasi-active membrane; sum-over-trips; cable theory

Software:

NEURON

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