Neuron modeling via Lorenz maps

Piotr Bartłomiejczyk

Discrete neuron models are useful tools in modeling neural dynamics They provide an alternative to usually computationally more expensive models based on continuous or hybrid dynamical systems. In [1, 2] we study two versions of the map-based model of neuronal dynamics proposed by by Courbage, Nekorkin and Vdovin (CNV). The first model (piecewise linear) was introduced in 2007 ([3]) and the second one (nonlinear) in 2010 ([4]). We show that their reduced one dimensional versions can be treated as independent simple models of neural activity, which still display very rich and varied dynamics. We carry out a detailed analysis of both periodic and chaotic behaviour of the models. In particular, using recent advances of the theory of Lorenz-like maps, we study firing patterns displayed by a reduced CNV model. This is joint work with Frank Llovera Trujillo and Justyna Signerska-Rynkowska.

References

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First Author: Piotr Bartłomiejczyk
Affiliation: *Gdańsk University of Technology*
80-233 Gdańsk, Poland
e-mail: piobartl@pg.edu.pl