Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Mode-Locking Behavior of Izhikevich Neuron Under Periodic External Forcing AMIRALI FAROKHNIAEE, EDWARD LARGE, Department of Physics , University of Connecticut — In this study we obtained the regions of existence of various mode-locked states on the periodic-strength plane, which are called Arnold Tongues, for Izhikevich neurons. The study is based on the new model for neurons by Izhikevich (2003) which is the normal form of Hodgkin-Huxley neuron. This model is much simpler in terms of the dimension of the coupled non-linear differential equations compared to other existing models, but excellent for generating the complex spiking patterns observed in real neurons. Many neurons in the auditory system of the brain must encode amplitude variations of a periodic signal. These neurons under periodic stimulation display rich dynamical states including mode-locking and chaotic responses. Periodic stimuli such as sinusoidal waves and amplitude modulated (AM) sounds can lead to various forms of n : m mode-locked states, similar to mode-locking phenomenon in a LASER resonance cavity. Obtaining Arnold tongues provides useful insight into the organization of mode-locking behavior of neurons under periodic forcing. Hence we can describe the construction of harmonic and sub-harmonic responses in the early processing stages of the auditory system, such as the auditory nerve and cochlear nucleus.

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Date submitted: 12 Nov 2014 Electronic form version 1.4