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Phase locking in driven integrate-and-fire neuron models

CHRISTOPHER BEDELL, Boston College, JAN R. ENGELBRECHT, Boston College — We investigate phase locking between a particular non-linear oscillator and a periodic drive. The non-linear equation we study is a reduced version of the celebrated Hodgkin-Huxley equations, which we couple to a cosine drive representing an EEG Rhythm. This model is motivated by the growing interest in the role of the exact timing of action potentials in neurons. For instance, electro-physiology experiments indicate that the phase differences between action potential times and large-scale oscillatory neuron activity (EEG rhythms) carry reliable information. We study various thresholds for phase locking and the delicate interplay between coherence and decoherence leading to chaos near these phase-locking thresholds.

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