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Homoclinic Spike adding in a neuronal model in the presence of noise IBIYINKA FUWAPE, ALEXANDER NEIMAN, Ohio University, Athens, Ohio, ANDREY SHILNIKOV, Georgia State University, Atlanta — We study the influence of noise on a spike adding transitions within the bursting activity in a Hodgkin-Huxley-type model of the leech heart interneuron. Spike adding in this model occur via homoclinic bifurcation of a saddle periodic orbit. Although narrow chaotic regions are observed near bifurcation transition, overall bursting dynamics is regular and is characterized by a constant number of spikes per burst. Experimental studies, however, show variability of bursting patterns whereby number of spikes per burst varies randomly. Thus, introduction of external synaptic noise is a necessary step to account for variability of burst durations observed experimentally. We show that near every such transition the neuron is highly sensitive to random perturbations that lead to and enhance broadly the regions of chaotic dynamics of the cell. For each spike adding transition there is a critical noise level beyond which the dynamics of the neuron becomes chaotic throughout the entire region of the given transition. Noise-induced chaotic dynamics is characterized in terms of the Lyapunov exponents and the Shannon entropy and reflects variability of firing patterns with various numbers of spikes per burst, traversing wide range of the neuron's parameters

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