1014-92-1017 **Daniel Tranchina** (tranchin@cims.nyu.edu), Courant Institute / NYU, 251 Mercer Street, New York, NY 10012, and **Felix J Apfaltrer*** (fapfaltrer@bmcc.cuny.edu), 199 Chambers Street, Department of Mathematics, BMCC / CUNY, New York, NY 10007. *Population density methods for stochastic neurons with a 2-D state space: application to neural networks with realistic synaptic kinetics.*

We explore the extension of a population density method for simulating electrical activity in networks of neurons to a 2D state-space. The method is applied to integrate-and-fire neurons with realistic synaptic kinetics. Neurons are grouped into populations of similar biophysical properties. Every population has a probability density function (PDF), which represents the distribution of neurons over state-space. The evolution equation of the PDFs are partial differential-integral equations (PDIEs). First, we model neurons with only excitatory synaptic input. If the unitary postsynaptic events are instantaneous (Nykamp and Tranchina, 2000) the PDF is 1D, as the neurons' state only depends on the random transmembrane voltage V_m. When synaptic kinetics are slower, and the unitary postsynaptic conductance event has a single-exponential time course; the state of the neuron depends on V_m and G_e, the random excitatory postsynaptic conductance. We formulate a pair of coupled PDIEs, one for neurons in the non-refractory state and the other for refractory neurons. The second state variable increases the computation time. We tackle this problem numerically by using an operator-splitting method. We compare our 2D results to Monte-Carlo simulations for speed and accuracy. (Received September 26, 2005)