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Multidimensional representations of the phase response curve for both type 1 and type 2 membrane excitability[1] ROBERT RAIDT, ANDREW J. SMITH, SORINEL A. OPRISAN, Department of Physics and Astronomy, College of Charleston — Neurons are complex excitable cells with a highly nonlinear response to external perturbations, such as presynaptic inputs and biological noise. Single-cell activity is determined by the properties of ionic channels and the ionic makeup of cell's environment and is mathematically described by coupled and nonlinear evolution equations. The phase resetting curve (PRC) reduces the complexity of the biophysical mechanisms involved in generating action potentials to tabulating advances or delays of subsequent spikes of a neuron due to an external perturbation. The PRC is widely used to predict the activity of large neural networks that by replacing the computationally intensive integration of evolution equations with lookup tables. The fundamental assumption of the PRC approach in predicting phase-locked modes in coupled neural networks is that the transient PRC measured for isolated and bursting neurons (open-loop) remains the same under the recurrent inputs of a phase-locked mode (close-loop). The novelties of our approach are: 1) the use of discrete sine transforms (DST's) to store the PRC's as a series of coefficients, and 2) the use of multidimensional stacks to represent multidimensional objects.

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