Robert J Rovetti, Loyola Marymount University, Los Angeles, CA, USA

Characterizing the behavior of a probabilistic lattice model of cardiac calcium release under different spatial and geometric conditions

We present a simulation study of a probabilistic discrete-time two-state lattice model that replicates physiological features of calcium release units within a cardiac cell, including threshold excitation, refractory period, and spatial interactions. Of particular interest is the emergence and persistence of periodic-like behavior in the ensemble average state value over time. After varying system size, aspect ratio, and maximum distance for spatial coupling, we find that stable (nonperiodic) behavior from beat to beat is best reinforced by a slightly oblong shape, a minimum size, and a restriction of spatial interactions to nearest-neighbor coupling, all of which are characteristic of mammalian cardiac cells. We also explore the consequences of imposing distributions on the underlying parameters of the model, mimicking the variability of number of channels and geometric arrangement of the release units in the cell.