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Bifurcation analysis of the rock–paper–scissors game with discrete logit dynamics

Abstract:

In this paper, we investigate a discrete-time version of logit dynamics applied to the Rock-Scissors-Paper game. We first show that around the Nash equilibrium point, an attracting closed invariant curve appears due to the Neimark-Sacker bifurcation. Next, near the resonance point, we find out a period-three attracting cycle, which can be thought of as a counterpart of the cyclically stable set in the Rock-Scissors-Paper game with best response dynamics [Gilboa and Matsui 1991]. Moreover, we show that the cycle can coexist with an attracting closed invariant curve, a period-three saddle cycle, and the attracting or repelling Nash equilibrium point. Finally, we use the codimension two bifurcation theory to specify the set of a heteroclinic bifurcation which destroys the coexistence of the attractors.