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Replicator Dynamics for Balanced Zero-Sum Games: A Visualization Toolbox

Joanna K. Nelson & **Adrian M. Bell**

University of Illinois at Urbana-Champaign [Mentor: Robert Muncaster]

Abstract of Poster Presentation: Our work in evolutionary game theory focuses on the replicator dynamics for a specially defined balanced zero sum game in which two players each have four strategy options and the rows and columns of the payoff matrix for the game sum to zero. Utilizing Mathematica we are able to analyze the replicator dynamics for the four stategies by visualizing the phase portraites on each side of a tetrahedron, as well as the family of manifolds on the interior of the tetrahedron. Each face of the tetrahedron represents the dynamics of three of the strategies in play. We then use this technology to analyze a variety of balanced zero sum games with differing payoff matricies. Due to the skew symetric nature of the payoff matrix for our family of balanced zero sum games, we found that $x \cdot Ax = 0$ and $(1,1,1,1) \cdot Ax = 0$, thus $(x_1x_2x_3x_4)' = 0$ which is a constant of motion. It is also true that a balanced zero sum game depends only on two parameters; making the bifurcation properties easier to examine than in other zero sum games. The constant of motion gives an infinite family of manifolds on the interior of the tetrahedron. The properties of the balanced zero sum game also gives a line of fixed points within the tetrahedron. [NJ10153557]

[Joint work with Dan Muriello]

Contact: jknelsn1@uiuc.edu & bella1@central.edu

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