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CHAOS AND GLOBAL BIFURCATIONS IN THE ROCK-SCISSORS-PAPER BIMATRIX GAME

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We consider a Rock-Scissors-Paper game assuming the perfect memory of the playing agents X, Y. The interaction matrices depend on two parameters $\epsilon_X, \epsilon_Y \in (-1, 1)$ and the dynamics are described by the coupled replicator equations. We provide the description of naturally appearing heteroclinic network and investigate asymptotic and chaotic behavior in its neighbourhood. It turns out that certain types of behaviours are never possible or appear in the system only for some parameter values, e.g. finite switching. In particular the infinite switching happening near the network cannot be described by the full-shift on two symbols and its form strongly depends on the parameter values. In the system we observe different bifurcation scenarios: e.g. transition from order to chaos (through Hamiltonian case where invariant tori and Hamiltonian chaos might be observed), loss of one dimension of the local stable manifold of the subcycle or disappearance and appearance of the local stable and unstable manifolds of the different subcycles at the same time. As well we investigate numerically the existence of the heteroclinic connection between different heteroclinic subcycles (i.e. a superheteroclinic orbit) and its bifurcation to the different heteroclinic connections (forward and backward) from the hyperbolic fixed point (i.e. Nash equilibrium) to the subcycles.

References

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