

Stability of two-dimensional and three-dimensional autonomous competitive Lotka-Volterra dynamical system

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Abstract. A detailed analysis of the stability of equilibriums of the two-dimensional autonomous competitive Lotka-Volterra dynamical system is conducted. Necessary and sufficient conditions are determined for equilibriums to be asymptotically stable or saddles. Necessary and sufficient conditions are determined for the observed dynamical system to have no equilibriums. Moreover, bifurcation analysis of that dynamical system is obtained. Concretely, we obtained that two transcritical bifurcations occur in the observed dynamical system. One transcritical bifurcation occurs for $d_{12} > 0$, $d_{112} > 0$, $d_{122} = 0$, while the other transcritical bifurcation arises for $d_{12} > 0$, $d_{112} = 0$, $d_{122} < 0$, where d_{12} is the main determinant of the matrix of the observed system, while d_{112} and d_{122} are its minors. Furthermore, stability of equilibriums of the three-dimensional autonomous competitive Lotka-Volterra dynamical system is inspected.

Keywords: Lotka-Volterra; dynamical systems; stability; equilibriums; bifurcations.