A Convex Approach for Controlled Lotka Volterra Multi-Species Models

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Recently, the coexistence of the multi-species, where the models consider switching or not, are analyzed in the references [1, 2]. The latter results employ a traditional approach and the coexistence of the species is taken into account by means of rational functions (switching terms) as in the references [3, 4, 5]. Since Lotka Volterra systems have more than one equilibrium point, an estimate of the region in which the species coexist is an important issue not yet fully addressed. One can provide an estimate of the coexistence region through the Linear Matrix Inequality (LMI [6]) framework and a Differential-Algebraic representation (DAR) of the system [7, 8]. It turns out that Lotka Volterra systems with no switching have no stable equilibrium points. In this work, a control term to stabilized the system is imposed extending the result obtained in [2]. An example illustrates the proposed methodology, where a system with three species (two prey and one predator in a two trophic level food chain) is considered.

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