TRANSITION BETWEEN FORWARD ATTRACTORS FOR A NON-AUTONOMOUS LOTKA-VOLTERRA SYSTEM.

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The autonomous Lotka-Volterra model is used to study the evolution of species population from an ecosystem, and the full characterization of the asymptotic behavior of their solutions is well known. In particular, it is possible to give conditions on the coefficients which guarantee the existence of a globally asymptotically stable equilibrium point, and construct the full structure of the global attractor associated through the heteroclinics connections between equilibrium points [1].

Based on the works of Lazer and Ahmad [2], [3], we provide a full characterization of the structure of attractors for a planar non-autonomous Lotka–Volterra cooperative system. We show sufficient conditions for the existence of forward attractors and give a full description of them by proving the existence of such bounded global solutions that all bounded global solutions join them, i.e. converge towards them when time tends to plus and minus infinity.

Furthermore, we obtain sufficient conditions on the problem parameters for different structures of attractors which leads to understanding different paths of the solutions towards the globally stable one. This change of the structure of the attractor will be determined at the value of the averages of the intrinsic growth rate vector a, seeing that depending on the sign of these averages the semistable solutions $(u_1^*, 0)$ and $(0, u_2^*)$ exist or not.

This is a joing work with José Antonio Langa and Piotr Kalita.

References

[1] Y. Takeuchi, (1996). *Global asymptotic dynamical properties of Lotka-Volterra systems.* World Scientific Publishing, 1996.

[2] S.Ahmad, A.Lazer. *On the nonautonomous N-competing species Problems.* Applicable Analysis. **57** (1995) 309-323.

[3] S. Ahmad, A. Lazer. *Necessary and sufficient average growth in a Lotka–Volterra system.* Nonlinear Analysis. **34** (1998) 191-228.
[4] J. Garcia-Fuentes, J.A. Langa and P. Kalita *Forwards attractor structures in a planar cooperative non-autonomous Lotka-Volterra system*, Qualitative Theory of Dynamical systems 23, 163 (2024).