

Uniform Persistence, Coexistence, and Extinction in Almost Periodic/Nonautonomous Competition Diffusion Systems

Dedicated to Professor Paul Waltman on the Occasion of his 70th Birthday

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Abstract

A two species competition model with diffusion is considered. The parameters describing the growth, interaction, and self-limitation of the species are spatially inhomogeneous and temporally almost-periodic. The boundary conditions are homogeneous and of Neumann or Dirichlet type. First, a convergence theorem is derived in the single species case. Roughly speaking, it states that one of the following alternatives will occur: either every positive solution converges to a unique strictly positive almost periodic solution, or every positive solution converges to the trivial solution, or every positive solution is neither bounded away from the trivial solution nor converges to it. Then appropriate conditions for uniform persistence of both species as well as for extinction of one of the species are established. Moreover, it is shown that uniform persistence implies coexistence in the sense that there is a strictly positive solution whose hull is almost automorphic. The above results generalize earlier work in the time independent and time-periodic case for both, single species population models and two species competition models. The approach developed in this paper for dealing with almost periodic equations, can be applied to more general non-autonomous equations as we will indicate by briefly discussing applications where merely time recurrence is supposed.

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