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Average conditions for permanence in N-species nonautonomous competitive systems of PDEs

In this talk we consider a nonautonomous systems of PDEs

$$
\begin{cases}
\dfrac{\partial u_i}{\partial t} = \Delta u_i + f_i(t, x, u_1, \ldots, u_N)u_i, & t > 0, \ x \in \Omega, \ i = 1, \ldots, N \\
\mathcal{B}u_i = 0, & t > 0, \ x \in \partial\Omega, \ i = 1, \ldots, N,
\end{cases}
$$

where Ω is a bounded domain with sufficiently smooth boundary $\partial\Omega$, Δ is the Laplace operator on Ω, and $\mathcal{B}$ is the boundary operator of the Neumann or Dirichlet type. Applying the Ahmad and Lazer's definitions of lower and upper averages of a function we give average conditions for the permanence of the system. In the Neumann case we also give a sufficient condition for the system to be globally attractive.