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Permanence for Kolmogorov competitive systems of PDEs

This talk is about recent results on permanence for Kolmogorov reaction–diffusion systems of partial differential equations (PDE)

$$\frac{\partial u_i}{\partial t} = \Delta u_i + f_i(t, x, u_1, \ldots, u_N)u_i, \qquad 1 \leq i \leq N,\ t \in [0, \infty),\ x \in \Omega.$$

Here $u_i(t, x)$ measures the population density of the i-th species at time t and spatial location x, and Ω is a bounded habitat. The system is endowed with appropriate boundary conditions.

Systems are assumed to be *competitive*, which means that $\partial f_i/\partial u_j \leq 0$ for $1 \leq i, j \leq N$, $i \neq j$ (usually much more will be assumed).

Permanence (sometimes called *uniform persistence*) means that any positive solution of the system becomes bounded away from zero, where the ultimate bound is independent of the solution.

We will give a survey of results on permanence for Kolmogorov competitive systems of PDEs, in particular with general dependence on time. Especially, connections with invasibility will be addressed.