

# Average conditions for permanence in nonautonomous competitive systems with nonlocal dispersal

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In this talk we consider the nonlinear evolution system.

$$\frac{\partial u_i}{\partial t} = \rho_i \left( \int_{\Omega} K_i(x, y) u_i(t, y) dy - u_i(t, x) \right) + f_i(t, x, u_1, \dots, u_N) u_i,$$
$$t \geq 0, x \in \bar{\Omega}, i = 1, \dots, N,$$

where  $u_i(t, x)$  is the density of the  $i$ th species at time  $t$  and spatial location  $x \in \bar{\Omega}$  and  $\Omega$  is a compact spatial region,  $\rho_i > 0$  is the dispersal rate of the  $i$ th species,  $f_i(t, x, u_1, \dots, u_N)$  is the local per capita growth rate of the  $i$ th species and  $K_i(\cdot, \cdot)$  is a nonlocal convolution kernel satisfying the following assumption:  $K_i(\cdot, \cdot) : \bar{\Omega} \times \bar{\Omega} \rightarrow \mathbb{R}$  are positive,  $C^1$ - functions such that  $\int_{\Omega} K_i(x, y) dy = 1$  for any  $x \in \bar{\Omega}$ ,  $i = 1, \dots, N$ . Applying Ahmad and Lazers definitions of lower and upper averages of a function and using the sub- and supersolution methods for PDEs we give sufficient conditions for permanence in such models. Moreover we allow the intrinsic growth rates to be negative.