Continuous-time differential-difference models in population dynamics and epidemiology

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We are interested in models of population dynamics and epidemiology that involve two phases, one active and one inactive, with exchanges between the two. The durations of these two phases can be finite or infinite. Depending on the phenomenon under study, the active and inactive phases may have different interpretations. For example, in a population model composed of immature and mature individuals, the mature phase may be considered active and the immature phase inactive. In a predator-prey model, for example, the inactive phase may represent a refuge where the prey population is protected from predators. It may also represent a resting phase for the predator, during which it does not hunt. In epidemiology, it may represent a period of immunity (temporary or permanent) due to vaccination. For a population of cells, the inactive phase may correspond to the quiescent phase G1/G0 and the active phase to the stages S/G2/M of the cell cycle that leads to cell division. One of the questions addressed by this type of model is the impact of the inactive phase on the asymptotic behavior of the solutions of the system. We will use continuous-time differential-difference models to investigate these questions.

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