PERMANENCE OF NONAUTONOMOUS RATIO-DEPENDENT PREDATOR-PREY SYSTEMS WITH PIECEWISE CONSTANT ARGUMENT OF GENERALIZED TYPE

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Abstract. In this paper, we investigate the dynamics of nonautonomous ratio-dependent predator-prey systems with piecewise constant argument of generalized type (PCAG) [3]. Sufficient conditions are established for some related qualitative properties such as positive invariance, permanence and non-persistence of the systems.

Keywords. Piecewise constant argument of generalized type, predator-prey systems, ratio-dependent response, permanence, non-persistence.

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1   Introduction and Preliminaries

Predator-prey systems with functional response have received great attention in recent years. Problems which appear in the analysis of such systems are quite complicated and challenging due to their dynamics. Predator-prey models with prey-dependent functional response of the form $p(x) = \dfrac{x}{m + x}$, where $m > 0$ is the half saturation constant, have been well studied. See, e.g., Freedman [16] and the references cited therein. Generally, the traditional prey-dependent model takes the form

$$\begin{aligned} x' &= x(a - bx) - cy\frac{x}{m + x}, \\ y' &= y(-d + f\frac{x}{m + x}), \end{aligned} \qquad (1)$$

where a prey population x serves as food for a predator population y. The model parameters a, b, c, d, f and m are assumed to be positive and they denote the growth rate of prey, strength of competition among individuals of prey species, capturing rate, death rate of the predator, conversion rate and the half saturation constant, respectively. Here, a/b is the carrying capacity