

Existence and Almost Periodicity for Some State-Dependent Delay Differential Equations

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In this work we study the existence and uniqueness of solutions for some state dependent delay differential equation of type.

$$\begin{cases} \frac{d}{dt}x(t) = F(t, x(t), x(t - \rho(x_t))), \text{ for } t \geq 0 \\ x_0 = \varphi \in C = C([- \tau, 0], \mathbb{R}^n) \end{cases} \quad (1)$$

When the nonlinear term is almost periodic, we prove the existence of an almost periodic solution. According to the book of Hale, it's well known if the term F is continuous, the equation has at least one maximal solution $x(., \varphi)$ which is defined on some interval $[0, t_\varphi)$ and t_φ is infinite or finite and in this case we have the blow up of solution:

$$\lim_{t \rightarrow t_\varphi} |x(t, \varphi)| = \infty.$$

The uniqueness is not true, even if F is lipschitzian with respect to the second argument, the uniqueness can be proved only for lipschitzian initial data φ , for this topic we refer to the work of Mallet-Parret . W. Alt proved the existence and periodicity for some state dependent delay differential equation. Recently Louihi has been proved the existence and uniqueness of solution for some autonomous state dependent delay differential equations, the authors have proved that the solutions generate a strongly semi group on the space of Lipschitz continuous function φ . Arino, Haderler and Hbid have proved also the existence of oscillatory and periodic solutions for some state dependent delay arising from population dynamic problems.

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