Oscillations in Differential Equations With State-Dependent Delays

K. NIRI[1] .

Recently, O.Arino, M.L.Hbid and R.Bravo de la Parra proposed a model in [1] describing the evolution of a population of fish whose larvae share a limited resource. The model is made of two equations: a state equation governing the evolution of the total number, which is a delay differential equation with variable delay, and a ordinary differential equation satisfied by the delay with coefficients expressed in terms of the state variable. A simplified version of the model which was presented is the following delay differential equations with delay depending directly on the state.

$$\begin{cases} \dfrac{dx}{dt} = -f(x(t-\tau(t))), \\ \dfrac{d\tau}{dt} = h(x(t),\tau(t)). \end{cases}$$

In [2], the authors studied the existence of slow oscillations and periodic slow oscillating solutions.
Here, we consider a general abstract formulation of this system :

$$\begin{cases} \dfrac{dx}{dt} = -f(x(t-\tau(x_t))), \\ \int_{t-\tau(x_t)}^{t} k(x(s))ds = k_o \end{cases}$$

and we extend, for this class of differential equations, results about necessary and sufficient conditions of oscillations which are well known in

[1]Département de Mathématiques et Informatique, Faculté des Sciences. Université Hassan II-Aïn chock, Casablanca, Maroc (e-mail:).

the case when the delay is constant, and in some classes of time-depending delay differential equations

References

[1] O.Arino,M.L.Hbid and R.Bravo de la Parra,A Mathematical model of population of fish in the larval stage: density-dependence effects.Math.Biosci.150,1998,1-20

[2] O.Arino,K.P.Hadeler and M.L.Hbid, Existence of periodic solutions for delay differential equations with state dependent delay.J.Diff.Equat.144,N2,1998,263-301