Stability and attractivity for Nicholson systems with time-dependent delays

Diogo Caetano, Teresa Faria

Lisbon, Portugal

We consider a class of $n$-dimensional Nicholson system with constant coefficients and multiple time-varying delays of the form

$$N_i'(t) = -d_i N_i(t) + \sum_{j=1, j \neq i}^{n} a_{ij} N_j(t) + \sum_{k=1}^{m} \beta_{ik} N_i(t - \tau_{ik}(t)) e^{-c_i N_i(t - \tau_{ik}(t))}, \; i = 1, \ldots, n, \; t \geq 0, \quad (1)$$

where $d_i > 0$, $c_i > 0$, $a_{ij} \geq 0$, $\beta_{ik} \geq 0$ with $\beta_i := \sum_{k=1}^{m} \beta_{ik} > 0$, and $\tau_{ik} : [0, \infty) \to [0, \infty)$ are continuous and bounded, for $i, j = 1, \ldots, n$, $k = 1, \ldots, m$.

Sufficient conditions on the coefficients are given for the existence and absolute global exponential stability of a unique positive equilibrium $N^*$, generalizing and improving known results for autonomous systems. Moreover, a delay-dependent condition is established for the positive equilibrium $N^*$ to be a global attractor of all positive solutions, and some corollaries which do not require the a priori knowledge of $N^*$ are derived.

Acknowledgement

The research was supported by Fundação Calouste Gulbenkian under project ‘Estímulo à Investigação’ (D. Caetano) and Fundação para a Ciência e a Tecnologia under project UID/MAT/04561/2013 (D. Caetano and T. Faria).

2010 Mathematics Subject Classification: 34K20, 34K25, 92D25.

References

