Global stability of an SIR epidemic model with time delay

Y.Takeuchi[1] .

We consider the global asymptotic stability of the well-known SIR epidemic model with a time delay described as:

$$\begin{cases} \dot{S}(t) = & -\beta S(t)I(t-h) - \mu_1 S(t) + b \\ \dot{I}(t) = & \beta S(t)I(t-h) - \mu_2 I(t) - \lambda I(t)\,, \\ \dot{R}(t) = & \lambda I(t) - \mu_3 R(t) \end{cases} \tag{1}$$

where, $S(t) + I(t) + R(t) \equiv N(t)$ denotes the number of a population at time t; $S(t)$, $I(t)$ and $R(t)$ denote the numbers of the population susceptible to the disease, of infective members and of members who have been removed from the possibility of infection through full immunity, respectively. It is assumed that all newborns are susceptible. The positive constants μ_1, μ_2 and μ_3 represent the death rates of susceptibles, infectives and recovered, respectively. It is natural biologically to assume that $\mu_1 \leq \min\{\mu_2,\ \mu_3\}$. The nonnegative constant h is the time delay.

The eventual lower bound obtained by the method given in [1] can be successfully applied to give the length of the time delay ensuring the global asymptotic stability of the endemic equilibrium point.

References

[1] W. Wang, Global behavior of an SEIRS epidemic model with time delay, *Appl. Math. Letters*, **15**, 423-428 (2002).

[1]: Department of Systems Engineering, Faculty of Engineering, Shizuoka University Johoku 3-5-1, Hamamatsu, Shizuoka 432-8561, Japan (e-mail: takeuchi@sys.eng.shizuoka.ac.jp).