

# GLOBAL STABILITY OF A POSITIVE EQUILIBRIUM FOR DELAYED EPIDEMIC MODELS AND IVGTT MODELS WITH NONLINEAR INCIDENCE RATES

YOICHI ENATSU

**ABSTRACT.** First, we investigate global dynamics of a delayed **SIRS epidemic models** with a class of nonlinear incidence rates. By means of unified construction methods of Lyapunov functionals based on LaSalle's invariance principle, we establish new sufficient conditions under which the positive equilibrium is globally asymptotically stable [1]. Some applications are also offered for related models such as a delayed viral infection model in [4]. In addition, we discuss some open problems for global stability of the positive equilibrium for the case that delay effects are incorporated in the incidence functions. The present results are based on joint work with Professor Yoshiaki Muroya (Waseda Univ.) and Dr. Yukihiro Nakata (Univ. of Szeged, Hungary).

Second, we introduce a delayed **Intra-Venous Glucose Tolerance Test (IVGTT) model** with a class of nonlinear incidence rates. In order to investigate the metabolic regulation between the glucose and insulin, Panunzi et al. [2] proposed a delayed IVGTT model with a bilinear incidence rate. Recently, by constructing a suitable Lyapunov functional, Li et al. [3] obtained delay-dependent conditions such that the positive equilibrium is globally asymptotically stable. In this talk, by applying the comparison principles and monotone iterative techniques, we also provide new delay-independent stability conditions for the global stability of the positive equilibrium.

## REFERENCES

- [1] Y. Enatsu, Y. Nakata and Y. Muroya, Lyapunov functional techniques for the global stability analysis of a delayed SIRS epidemic model, *Nonlinear Analysis: Real World Applications* **13** (2012) 2120-2133.
- [2] S. Panunzi, P. Palumbo and A. De Gaetano, A discrete single delay model for the intra-venous glucose tolerance test, *Theor. Biol. Med. Mod.* **4** (2007), doi:10.1186/1742-4682-4-35.
- [3] J. Li, M. Wang, A. De Gaetano, P. Palumbo and S. Panunzi, The range of time delay and the global stability of the equilibrium for an IVGTT model, *Mathematical Biosciences* **235** (2012) 128-137.
- [4] Y. Nakata, Y. Enatsu and Y. Muroya, Complete global dynamics of a delayed viral infection model with lytic and nonlytic effectors, *SeMA Journal*, *in press*.

(Yoichi Enatsu) GRADUATE SCHOOL OF FUNDAMENTAL SCIENCE AND ENGINEERING, WASEDA UNIVERSITY, 3-4-1 OHKUBO, SHINJUKU-KU, TOKYO 169-8555, JAPAN

*E-mail address:* y.enatsu@kurenai.waseda.jp

---

2000 *Mathematics Subject Classification.* 34K20, 34K25, 92D30.

*Key words and phrases.* Epidemic model; IVGTT model; Time delay; Global asymptotic stability; Lyapunov functional.