2019 9th International Conference on Applied Physics and Mathematics (ICAPM 2019)
Jan. 21-23, 2019 | Bangkok, Thailand

Delay-induced stability switches in an SIRS epidemic model with saturated incidence rate and temporary immunity

Anthony Meneses Pasion and Juancho Arranz Collera

Department of Mathematics and Computer Science, University of the Philippines Baguio, Governor Pack Road, Baguio City 2600, Philippines

ampasion@up.edu.ph, jacollera@up.edu.ph

Abstract. This work considers a time-delayed SIRS epidemic model with temporary immunity and nonlinear incidence rate, where the susceptible host population satisfies the logistic equation and the incidence rate is of saturated form with the susceptible. The time delay represents a period of temporary immunity where disease-recovered individuals return to the susceptible class after a fixed period of time. By analyzing the associated characteristic equation with delay-dependent coefficients and regarding the time lag as the bifurcation parameter, the local stability of the endemic equilibrium is investigated and sufficient conditions for the occurrence of stability switches via Hopf bifurcations are obtained. It is shown that the delay parameter can induce a finite number of stability switches before completely destabilizing the system. Numerical simulations are carried out to illustrate theoretical results.

Keywords: Delayed SIRS model, Stability switch, Hopf bifurcation

Scope of Abstract: Applied Mathematics