

An age-structured epidemic model with boosting and waning of immune status

Prof. Hisashi Inaba
Department of Mathematics, Graduate School of Mathematical Sciences
The University of Tokyo
Tokyo, Japan

Abstract

In this talk, I would like to introduce some recent results obtained for an age-structured epidemic model that takes into account boosting and waning of immune status of host individuals. For many infectious diseases, the immunity of recovered individuals may be waning as time evolves, so re-infection could occur, but also their immune status could be boosted if they have contact with infective agent. According to the Aron's malaria model, we incorporate a boosting mechanism expressed by reset of recovery-age (immunity clock) into the SIRS epidemic model. We first prove mathematical well-posedness of the basic model. Next, we establish the condition for disease invasion and the existence of endemic steady states based on the basic reproduction number R_0 . Finally, we examine the condition to determine the direction of bifurcation of endemic steady states bifurcated from the disease-free steady state, and we show that a backward bifurcation could exist under the waning and boosting of immune status.