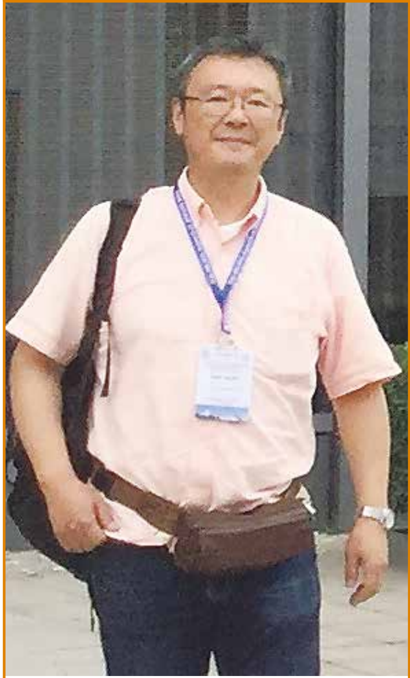


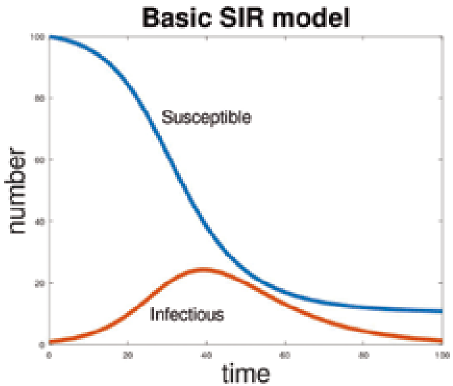
Prof.
SASAKI Toru

Mathematical analysis of models describing infectious disease

Propagation of an infectious disease in a population, and the dynamics of density of pathogen in vivo are investigated by using mathematical models. Those mathematical models consist of systems of functional equations, such as ordinary differential equations and partial differential equations. For example, in the case of spread of an infectious disease, a susceptible becomes an infectious by a contact with an infectious, and the numbers of susceptible and infectious agents change. The numbers as unknown variables satisfy functional equations. If the population is uniformly mixing, then the equations are ordinary differential equations. If age-structure or spatial diffusion is considered, then the equations are partial differential equations. We investigate those models in a mathematical point of view, and develop the method of analysis for those models.

Basic virus dynamics:

$$\frac{dx}{dt} = \lambda - mx - \beta xv$$
$$\frac{dy}{dt} = \beta xv - ay$$
$$\frac{dv}{dt} = ary - bv - \beta xv$$



SIS model with diffusion:

$$\frac{\partial NS}{\partial t} = \nabla \cdot (\kappa \nabla (NS)) - \lambda SNI + \gamma NI + \mu N - \mu NS$$
$$\frac{\partial NI}{\partial t} = \nabla \cdot (\kappa \nabla (NI)) + \lambda SNI - \gamma NI - \mu NI$$