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Modeling and analyzing the dynamics of epidemic spreading on homogenous and heterogeneous networks

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This study proposes the two modified susceptible-infected-recovered-susceptible (SIRS) models on homogenous and heterogeneous networks to describe epidemic spreading. The SIRS models consider the role of vaccinated population and different death rates for susceptible individuals and infectious individuals. It has been proved that if the basic reproduction number R_0 of the model is less than one, then the disease-free sate is locally stable. The disease will disappear if the threshold value R_1 of the model is less than one. Otherwise, if $R_0>1$ and under some assumption, the total population N will tend to a specific plane. In the study of the heterogeneous network model, this paper discusses the existence of the disease-free equilibrium and endemic equilibrium of the model. It is proved that if the threshold value R_0 is less than one, then the disease will disappear. Otherwise if R_0 is more than one, the system is permanent. The analysis shows that high percentage of vaccinated population, low connectivity between the susceptible and infectious, and high death rate of infected population are important factors to make epidemic diseases disappear. Numerical simulations are given to illustrate the theoretical results. This study will numerically predict the effect of vaccination ratio on the size of HBV infected mainland Chinese population.

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Biography

Lequan Min is currently a Professor in Mathematics and Physics School, and the PhD supervisor with the Automation School at the University of Science and Technology Beijing. His current research interests are modeling and simulations of complex systems in particular to the virus infections and epidemic spreading. He is also the author or co-author of over 200 scientific journal and conference papers.

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