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*Asymptotic and Transient Dynamics of SEIR Epidemic Models on Weighted Networks*

In modelling specific infectious diseases, such as COVID-19, populations tend to be inhomogeneous and there are nonlocal interactions as the disease spreads spatially via travelling. Therefore, it is very important to investigate the effects of host heterogeneity on the spatial spread of infectious diseases. We study the effect of population mobility on the transmission dynamics of infectious diseases by considering a susceptible-exposed-infectious-recovered (SEIR) epidemic model with graph Laplacian diffusion; that is, on a weighted network. First we establish the existence and uniqueness of solutions to the SEIR model defined on weighed graph. Then by the means of constructing Liapunov functions, we show that the disease-free equilibrium is globally asymptotically stable if the basic reproduction number is less than unity and the endemic equilibrium is globally asymptotically stable if the basic reproduction number is greater than unity. Finally we apply our generalized weighed graph to Watts-Strogatz network and carry out numerical simulations, which demonstrate that degrees of nodes determine the peak numbers of infectious population as well as the time to reach these peaks. It also indicates that the network has an impact on the transient dynamical behavior of the epidemic transmission. The node degrees determine the peak of infected population, where the greater the degree the higher the peak attains.