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PAPER

Stochasticity in SIRV Models for the transmission of epidemic diseases

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Some well-known classic models of infectious disease population dynamics have been deterministic. General models, such as the SIRV (Susceptible, Infective, Recovered and Vaccinated) have proven useful in ascertaining gross factors affecting rate of growth and final size of an epidemic. However, it seems that the nature of epidemic growth and spread is for the most part stochastic. It is apparent that some diseases do not fit general simplified schemes and hence, require special consideration of their details since they have characteristic modes of transmission. A common way of modifying a deterministic model is through introducing the stochasticity: Markov chain approach is one such common way.

In this research, continuous-time and continuous-state space variables are used to modify the deterministic system. Consequently, stochastic differential equations (SDE) are used. The purpose of the research is to get a wider insight into the dynamic of an SIRV model with various strategies of vaccination procedures. Two vaccination methods, namely pulse vaccination and vaccination of newborns, are used to compare the effectiveness of the controlling of an epidemic. It has been apparent that stochasticity has a positive effect on the stability of the disease dynamic. These results are illustrated by performing numerical simulations with appropriate parameter values using MATLAB.

Keywords: Epidemic Diseases, Vaccination, Stochastic Differential Equation