

Dynamics of a Susceptible-Infected-Recovered Model along with Time Delay, Modulated Incidence, and Nonlinear Treatment

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Abstract : As we know that, time delay exists almost in every biological phenomenon. Therefore, in the present study, we propose a susceptible-infected-recovered (SIR) epidemic model along with time delay, modulated incidence rate of infection, and Holling Type II nonlinear treatment rate. The present model aims to provide a strategy to control the spread of epidemics. In the mathematical study of the model, it has been shown that the model has two equilibriums which are named as disease-free equilibrium (DFE) and endemic equilibrium (EE). Further, stability analysis of the model is discussed. To prove the stability of the model at DFE, we derived basic reproduction number, denoted by (R_0). With the help of basic reproduction number (R_0), we showed that the model is locally asymptotically stable at DFE when the basic reproduction number (R_0) less than unity and unstable when the basic reproduction number (R_0) is greater than unity. Furthermore, stability analysis of the model at endemic equilibrium has also been discussed. Finally, numerical simulations have been done using MATLAB 2012b to exemplify the theoretical results.

Keywords : time delayed SIR epidemic model, modulated incidence rate, Holling type II nonlinear treatment rate, stability

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