STABILITY ANALYSIS OF SIR EPIDEMIC MODEL UNDER VACCINATION COVERAGE ON NEWBORNS WITH TIME DELAY ON SUSCEPTIBLE INDIVIDUALS

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Abstract. In this paper, a three-compartment SIR epidemic model under vaccination coverage on newborns with time delay on susceptible individuals is considered and discussed local stability at its equilibrium points. Hopf-bifurcation is used to identify the point at which system becomes unstable to stable. Numerical simulation is carried out to support the results using MATLAB. Numerical examples are presented in support of the increase in the transmission rate at a particular critical time delay parameter the system becomes unstable. Also, with increase in the proportion of vaccination in the newborns subject to fixed time delay, there is an increase in the recovered individuals and decrease in the infected individuals. Further, due to increase in the time delay, the susceptible individuals remain in the compartment without getting infected rapidly.

Keywords. Vaccination, disease free equilibrium point, endemic equilibrium point, time delay, Hopf-bifurcation.

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1 Introduction

In this world, there is a never ending threat to human kind and animals where the infections and diseases are caused by various factors and can also spread by airborne virus or bitten by a virus carrier. These infection causing agents become strong and cause suffering which leads to socio economic loss. The intensity of the disease in population depends on the nature and the mode of transmission of the disease which indicates the method through which a disease carrying agent travels to the new host.

Time delay is an important consideration to be taken to make epidemic models look more practical and realistic. There are many authors who worked on epidemic models incorporating delay or distributed delay in the models.