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Optimization of efficiency of antiviral therapy in hepatitis B virus infection

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Mathematical models have been used to understand the factors that govern infectious disease progression in viral infections like hepatitis B (HBV). The mathematical models of HBV including antiviral therapy have been studied by many research groups throughout the world during the last two decades. However, all these studies have considered the forward problem of simulating the model for a given set of parameters /clinical data. Optimal control of efficiency of antiviral therapy in HBV model has not been discussed. This study considers an optimal control problem for a mathematical model of efficiency of antiviral therapy in HBV virus infection. The aim of the study is to control the new viral production, block the new infection cells and maintain the number of uninfected cells within a given range. The optimal controls represent the efficiency of antiviral therapy in inhibiting viral production and preventing new infections. Defining the cost functional, the optimal control problem is converted into the constrained optimization problem and the first order optimality system is derived. For the numerical simulation, we propose the steepest descent algorithm based on the adjoint variable method. A computer program in MATLAB was developed for the numerical simulations.