Abstract

Numerical optimization techniques are useful in solving problems of computing the best inputs for systems described by mathematical models and when the objectives can be stated in a quantitative form. This work concerns the problem of optimizing the drug doses in the treatment of AIDS in terms of achieving a balance between the therapeutic response and the side effects. A mathematical model describing the dynamics of HIV viruses and CD4 cells is used to compute the short term optimal drug doses in the treatments of patients with AIDS by a direct method of optimization using a cost function of Bolza type. The model parameters were fitted to actual published clinical data. In order to simplify the numerical procedures, the control law is expressed as a series and the sub-optimal control is obtained by truncating the higher terms. When the patient reaches a clinically satisfactory state, the LQR Linear Quadratic Regulator technique is used to determine the long period maintenance doses for the drugs. The doses computed using the LQR technique tend to be smaller than equivalent constant-dose therapy in terms of increase in the counts of CD4+T cells and reduction of the density of free viruses.

Keywords

modeling, simulation, drugs, treatment, AIDS.