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Control of HIV/AIDS Infection System with Reverse Transcriptase Inhibitors Dosages Design via Robust Feedback Controller

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Abstract

Acquired Immune Deficiency Syndrome (AIDS) is a disease or continuum condition which is due to Human Immunodeficiency Virus (HIV) infection. One in five people are infected with HIV are not aware of the infection. Early detection of the infection helps the infected people to take medications to avoid future consequences and reduce the risk of transmitting the disease. Reverse transcriptase inhibitors (RTIs) were the first available drug and were considered a principal kind of medication available to treat HIV patients. These drugs are still successful, effective, and are considered to have imperative solutions for treating HIV when joined with different medications. Investigating effect of this branch of the drugs on HIV and model this interaction has a great of importance to control AIDS.

This need can be addressed by the control system engineering which uses control theory to estimate and design a system. Since Stability is the most significant requirement of the system, and a system of instability cannot be expected for a particular transient reaction or steady state error specification then objective which is needed to be achieved by working on this research is to design a stabilized model of a patient having AIDS. In this research feedback controllers, Root locus technique and Routh Hurwitz method have been adopted to design such an advanced transformative controller which robustly regulates RTIs infusion dosages considering the amount of HIV viruses in infected human body.

Keywords: A D ; [illegible]

Introduction

A D [illegible] A [illegible] D [illegible] [1-4]. [illegible] A [illegible] A [illegible] [5,6]. [illegible] [7,8] [illegible] D [illegible] D [illegible] [9,10] [illegible] A D [illegible] [4,11] [illegible] A D [illegible] [12] [illegible] [13] [illegible] CD4 [14] [illegible] CD4 [illegible] 200 [illegible] / [illegible] 3 [illegible] A D [15].

[illegible] A D [illegible] [16,17]. [illegible] [18,19] [illegible] CD4 [illegible] CD4 [illegible] [20,21]. [illegible] [22] [illegible] [23].

Methodology

[illegible] [24]. A [illegible]

[illegible] [25] [illegible] [24] [illegible]

[illegible] [26] [illegible]

A [illegible]

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[illegible] 27 [illegible]

Feedback system

[illegible] 28 [illegible] 29 [illegible] 30 [illegible]

$$X(s)=(sI-A)^{-1}x(0)+(sI-A)^{-1}BU(s) \quad (3)$$

$$Y(s)=CX(s)+DU(s) \quad (4)$$

State space representation

Routh-Hurwitz method

Root locus

Results and Discussion

$$\frac{dT}{dt}=s-dT-\beta Tv \quad (5)$$

$$\frac{dT^*}{dt}=\beta Tv-\mu T^* \quad (6)$$

$$\frac{dT}{dt}=\frac{dT^*}{dt}=\frac{dv}{dt}=0 \quad (7)$$

$$f_2 = \left(1 - u_1\right)\beta T v - \mu T^* \qquad (10)$$

$$f_2 = \left(1 - u_1\right)\beta T v - \mu T^* \qquad (11)$$

$$f_3 = \left(1 - u_2\right) k T^* - c v \qquad (12)$$

$$\begin{bmatrix} \frac{\partial_1}{\partial} & \frac{\partial_1}{\partial^*} & \frac{\partial_1}{\partial} \\ \frac{\partial_2}{} & \frac{\partial_2}{*} & \frac{\partial_2}{} \\ \frac{3}{} & \frac{3}{*} & \frac{3}{} \end{bmatrix} \quad \begin{bmatrix} \frac{\partial_1}{\partial_1} & \frac{\partial_1}{\partial_2} \\ \frac{2}{1} & \frac{2}{2} \\ \frac{3}{1} & \frac{3}{2} \end{bmatrix}$$

8. Carrington