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HIV Model Analysis, State Estimation and Optimal Control.

We will present a nonlinear model for the dynamics of HIV infection. This model includes multiple target cells, multiple treatment methodologies and virus specific immune response. It will be shown how an optimal control based treatment strategy can stimulate the virus specific immune response. The dynamics of the model will be studied under this treatment schedule through the application of sensitivity equations and parameter identifiability. In light of the inexact nature of biological models and data measurement errors, we will show how stochastic estimation can be used as a tool to both track state dynamics and estimate unknown model parameters. With these two methodologies developed we will then implement a Receding Horizon based feedback control based treatment strategy. Finally we will look at a system level model of HIV with drug resistance and how system level models can be related to genetic level information. (Received September 10, 2010)