Eighth Workshop Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2017
Évora, Portugal, January 31st - February 3rd, 2017

STABILITY AND OPTIMAL CONTROL OF A HIV MODEL WITH INTRACELLULAR AND PHARMACOLOGICAL DELAYS

Filipe Rodrigues[1], Cristiana J. Silva[1]*, Delfim F. M. Torres[1], and Helmut Maurer[2]

[1]Center for Research and Development in Mathematics and Applications (CIDMA)
Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal

[2]Institute of Computational and Applied Mathematics
University of Münster, D-48149 Münster, Germany

fmgrodrigues@ua.pt, cjoaosilva@ua.pt (*corresponding author),
delfim@ua.pt, maurer@math.uni-muenster.de

Time delay plays an important role in the dynamics of HIV infection. Intracellular delay is the time delay between initial infection of a cell by HIV and the release of new virions. We propose a model for the human immunodeficiency virus type 1 (HIV-1) infection with intracellular delay and prove the local asymptotical stability of the equilibrium points. Then we introduce a control function representing the efficiency of reverse transcriptase inhibitors and consider the pharmacological delay associated to the control. Finally, we propose and analyze an optimal control problem with intracellular and pharmacological delays, that is, state and control delays. Through numerical simulations, extremal solutions are proposed for minimization of the virus concentration and treatment costs. We compare the extremal of our optimal control problem with state and control delays with the solutions of the uncontrolled problem and the control problem with delay in the state variable only [1, 2].

References

[1] D. Rocha, C. J. Silva and D. F. M. Torres. *Stability and optimal control of a delayed HIV model*, Math. Methods Appl. Sci., in press. DOI: 10.1002/mma.4207

 ISBN: 978-989-98750-3-6

[2] F. Rodrigues, C. J. Silva, D. F. M. Torres and H. Maurer. *Optimal control of a delayed HIV model*, submitted.

 ISBN: 978-989-98750-3-6