DEPARTMENT OF COMPUTATIONAL SCIENCE & ENGINEERING,
YONSEI UNIVERSITY, SEOUL 120-749, KOREA

CSE Seminar

15th May 2014 , 3PM

Science Hall Room 227, Yonsei University, Seoul, Korea

Lecture 1

Yang Kuang

Department of Mathematics, Arizona State University

Dynamics and Implications of a Model of Hepatitis B Virus Infection with Time Delay

Abstract

Chronic HBV affects 350 million people and can lead to death through cirrhosis-induced liver failure or hepatocellular carcinoma. We analyze the dynamics of a model considering logistic hepatocyte growth and a standard incidence function governing viral infection. This model also considers an explicit time delay in virus production. With this model formulation all model parameters can be estimated from biological data; we also simulate a course of lamivudine therapy and find that the model gives good agreement with clinical data. Previous models considering constant hepatocyte growth have permitted only two dynamical possibilities: convergence to a virus free or a chronic steady state. Our model admits a third possibility of sustained oscillations. We show that when the basic reproductive number is greater than 1 there exists a biologically meaningful chronic steady state, and the stability of this steady state is dependent upon both the rate of hepatocyte regeneration and the virulence of the disease. When the chronic steady state is unstable, simulations show the existence of an attracting periodic orbit. Minimum hepatocyte populations are very small in the periodic orbit, and such a state likely represents acute liver failure. Therefore, the often sudden onset of liver failure in chronic HBV patients can be explained as a switch in stability caused by the gradual evolution of parameters representing the disease state.

Lecture 2

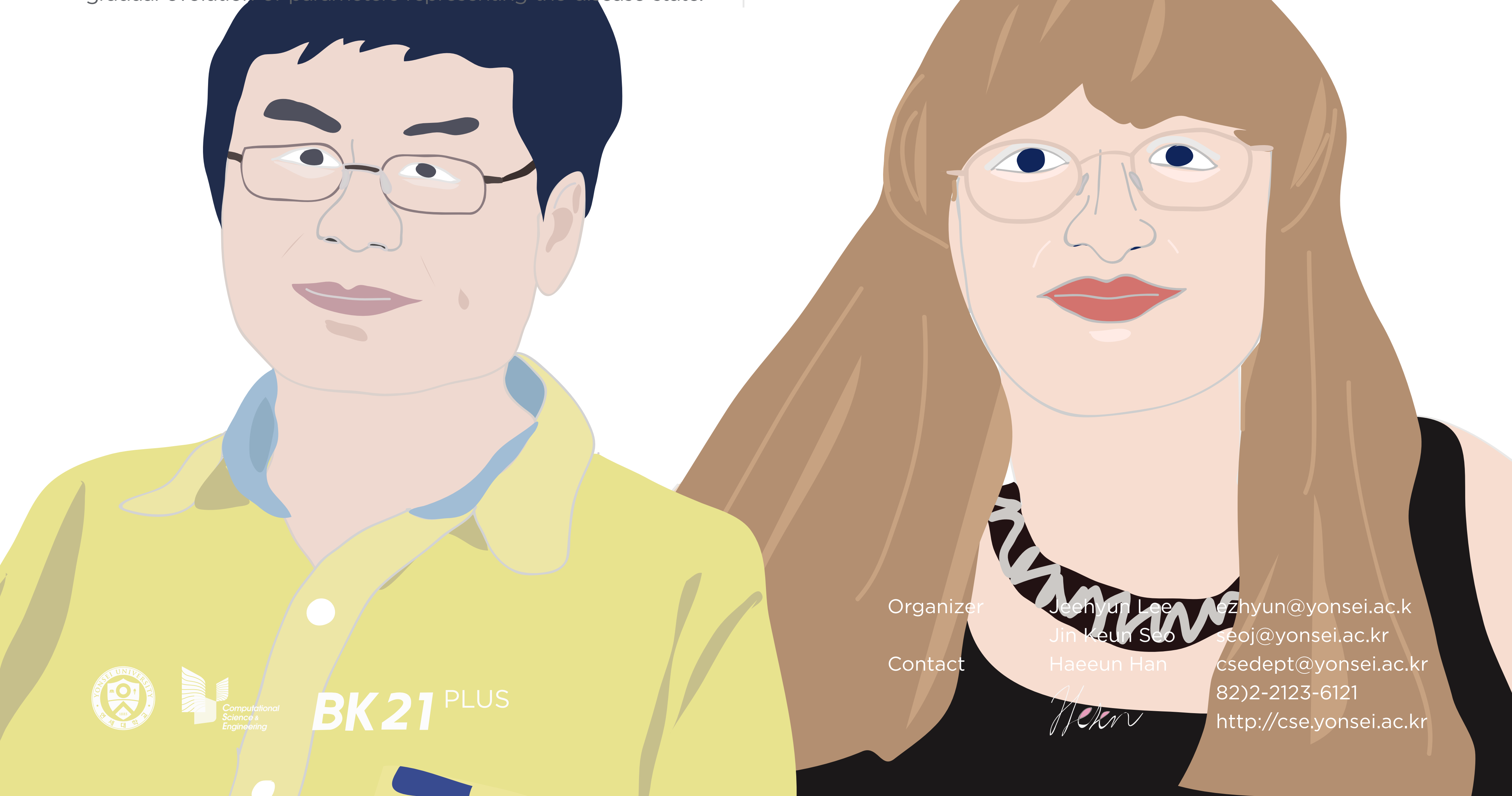
Urszula Ledzewicz

Department of Mathematics and Statistics
Southern Illinois University Edwardsville

Geometric Optimal Control Applied to Combination Therapies for Cancer: Results and Open Problems

Abstract

In this talk we shall analyze mathematical models for combination therapies for cancer as optimal control problems. We shall consider combinations of novel treatment approaches like tumor anti-angiogenesis or immunotherapy with traditional treatments, like chemotherapy or radiotherapy. Mathematical models for these therapies become multi-input control problems with each control modeling a separate drug action. There exist various approaches for choosing the objective like minimize the size of the tumor at the end of treatment or to maximize the immunocompetent cell-densities (if included in the model) while keeping side effects low. This leads to optimal control problems with many challenging features due to their multi-input system structure. Analytical and numerical results about the structures of optimal controls will be presented providing insights into dosage and sequencing of the drugs in these treatments. Throughout the lectures, the relations between the obtained mathematical results and medical data will be addressed, indicating challenges and open problems. In particular, a connection between theoretically obtained singular controls and the clinical benefits of metronomic chemotherapy will be discussed as a new important direction being currently explored.



Organizer Jeehyun Lee ezhyun@yonsei.ac.k
Jin Keun Seo seoj@yonsei.ac.kr
Contact Haeeun Han csedept@yonsei.ac.kr
82)2-2123-6121
http://cse.yonsei.ac.kr

Helen

BK21 PLUS