Program: **BG09, "LINEAR QUADRATIC DIFFERENTIAL GAMES AND APPLICATIONS"**
Grant: Д03-91/ 27.05.2015
Sofia University "St. Kl. Ohridski"
Activity 4: Carrying out a PhD class of lectures "Linear Quadratic Differential Games and Applications"

FACULTY OF ECONOMICS SOFIA UNIVERSITY "St.Kl.Ohridski"

125 Tzarigradsko chaussee blv., bl.3, hall 417 , Sofia
PhD COURSE – THE PROGRAM

9 May 2016   Monday, hall 417
Prof. Ivan Ivanov
Ivan Ivanov received his Ph.D. in computational mathematics in 1994 from Sofia University "St. Kl. Ohridski". He is currently a full Professor at the Department of Statistics and Econometrics in the Sofia University. His research interests are in the areas of computational methods for solving nonlinear matrix equations and their applications. He did postdoctoral research at Sofia University and he obtained his doctor of science degree in applied and computational mathematics from Sofia University in 2008. His research activities include also optimal stochastic control problems, mathematical economics, nonlinear matrix equations, computational methods in the game theory. He is a member of the International Linear Algebra Society (ILAS). He is a member of a Editorial board of five international journals.

14:15 - 15:30 Lecture 1. Game theory - equilibrium states – definitions and properties. Linear quadratic games.
15:45 - 17:00   Lecture 2. Riccati equations with applications to the finding of the Nash equilibrium in the deterministic case. The game-theory approach for the solution of H_∞ optimization problems. The Lanzon method.
17:15 - 18:00 Lecture 3. Extensions of   Lanzon's method. Riccati equations with positivity properties.
18.00- 19.00 – Discussion

10 May 2016 Tuesday , hall 417
Assoc. Prof. Snejana Kostova
Snezhana Kostova received her MSc in Mechanical Engineering from Technical University, Rouse (1982), specialization of Applied Mathematics and Informatics at the Technical University of Sofia (1983) and PhD on *Control Systems* from the the Institute of Control and System Research (ICSR), Bulgarian Academy of Sciences (2002). She habilitated as an Associate Professor in

Application of Principles and Methods of Cybernetics in Different Areas of Science in 2007. From 2007 to 2010 she was Associate Professor at ICSR-BAS and since 2010 she is Associate Professor at the Institute of Systems Engineering and Robotics of BAS (ISER-BAS). Her research interests include theory and applications of dynamic systems, positive systems, modelling and robotics.

9:15 am - 10:00 am. Lecture 1. Introduction in the theory and application of model predictive control of linear systems.
Coffee break   10:00 am - 10:30 am.
10:30 am - 11:30 am. Lecture 2.   Game theory with engineering problems
11:45 am - 13:00   Lecture 3. Application of game theory to positive linear control systems
13.00- 14.00 – Discussion

11 May 2016 Wednesday
 Prof. Vasile Dragan
9:15 am - 10:00 am. Lecture 1. On the linear quadratic optimization problems and associated Riccati equations for systems modeled by Ito linear differential equations.
Coffee break   10:00 am - 10:30 am.
10:30 am - 11:30 am. Lecture 2. On computing the stabilizing solution of the algebraic Riccati equation arising in connection with a class of zero sum stochastic linear quadratic differential games.
11:45 am - 13:30. Prof. Viorica Dragan – Discussion

12 May 2016 Thursday
Prof. Lars Imsland
Lars Imsland received the Ph.D. degree in electrical engineering from the Department of Engineering Cybernetics, Norwegian University of Science and Technology (NTNU), Trondheim, Norway. He was a Visiting Research Scholar with the Institute for Systems Theory in Engineering, University of Stuttgart, Stuttgart, Germany, for part of his Ph.D. studies. He was a Post-Doctoral Researcher with NTNU, a Research Scientist with SINTEF, Trondheim, and a Specialist with Cybernetica AS, before becoming a full-time Professor of Control Engineering with NTNU in 2009. His current research interests include theory and application of nonlinear optimizing control and estimation. Examples of applications are within the oil and gas industry (both drilling and production), active safety in the automotive industry, and the use of mobile sensor networks for monitoring of local ice features.

9:15 am - 10:00 am. Lecture 1. Lecture 1: Numerical methods
   - Constrained optimization, nonlinear programming
   - Direct methods for numerical optimal control
   - Discretization approaches (shooting methods, collocation methods)

- Algorithmic differentiation, software

Coffee break   10:00 am - 10:30 am.

10:30 am - 11:30 am. Lecture 2. Model predictive control
- Receding horizon implementation
- Stability of model predictive control
- Linear vs nonlinear
- Economic vs regulatory objectives
- Example 1: Production optimization in oil and gas production

11:45 am - 12:30 am. Lecture 3. Application examples
- Example 1 continued.
- Example 2: Path planning for unmanned aerial vehicles for monitoring of ice features

12.30- 13.30 – Discussion

13 May 2016 Friday, hall 417
Assoc. Prof. Boryana Bogdanova

9:15 am - 10:00 am. Lecture 1. An Introduction to Global Coordination Games
Coffee break   10:00 am - 10:30 am.
10:30 am - 11:30 am. Lecture 2. An Application of Global Coordination Games to the Problem of Financial Contagion
 11:45 am - 12:30 am. Lecture 3. A Wavelet Application to Global Coordination Games Contagion Model.

12.30- 13.30 – Discussion and Closing

"Certificates" for successfully completed course of lectures will be awarded to the participants.

Questions and comments: i_ivanov@feb.uni-soifa.bg; bpelova@gmail.com