



High School Students & Teachers Workshop on

The Power, Beauty and Excitement of the Cross-Boundaries Nature of Control

Date: 3 July 2005 (Sunday)

Time: 09:00 – 16:45

Place: Czech Technical University in Prague, Technicka 2, 166 27 Praha 6

Workshop Organisers:

- Technical Committee on Education of the International Federation of Automatic Control (IFAC)
- Technical Committee on Education of the Control Systems Society, the Institute of Electrical and Electronics Engineers (IEEE)

Program and Speakers:

The Workshop aims to inspire interest from youth towards studies in Automatic Control and to assist high school teachers in promoting the discipline of Automatic Control among their students. It is composed of several short but effective presentations on various problems from the real world that have been solved by using control engineering methods, techniques and technologies. The attractiveness and excitement of choosing a career in control engineering will also be addressed. Live interaction between the presenters and the audience is to be an important feature of the Workshop.

09:00 – 09:45 **The Power of Feedback**

Theodore E. Djaferis
Professor and Associate Dean of Engineering
University of Massachusetts, Amherst, USA

Automatic control is a fascinating field of study. The theory and practices developed over the years can be applied to a wide range of automation problems, making the field universally applicable. Automatic control is truly multidisciplinary as problems frequently involve a number of disciplines. In this talk we shall explore the use of feedback in automatic control applications. Rather than talking in broad terms we will introduce the subject by considering a specific example - an automatic control system for vehicle collision avoidance. This will lead to a better understanding of the different pieces involved in the automatic control puzzle and the process used to solve problems.

09:45 – 10:30 **When Computers Control: Joys and Perils of Automation**

Christos G. Cassandras
Professor of Manufacturing Engineering, and
Professor of Electrical and Computer Engineering
Boston University, USA

The purpose of this presentation is to demonstrate the pervasive role of feedback in both physical and manufactured systems, thus motivating "automatic control". This presentation also tries to show the pitfalls of automation, when it's not done "quite right", thus introducing basic challenges in environments ranging from manufacturing to communication networks and transportation. Computer simulation and a LEGO-based mini-car factory are presented as examples of educational tools for teaching the principles and challenges of automatic control.



10:30 – 11:00 Refreshments

Break for refreshments with presenters, control scientists and engineers mingling with the attendees in informal chats.

11:00 – 11:45 Future Careers in Mechatronics and Control Systems

Mark W. Spong
Donald Biggar Willett Professor of Engineering
Urbana, USA

Mechatronics is the synergistic combination of precision mechanical engineering, electronic controls and systems engineering in the design of products and processes. Mechatronic Systems are "smart systems" of all kinds including robots, drive-by-wire cars, fly-by-wire airplanes, and consumer electronics. This talk will give examples of advances in control systems and mechatronics and discuss career opportunities for students in these areas.

11:45 – 12:30 Increased Role of Automation Techniques in Large Industrial Projects

Petr Horacek
Associate Professor and Department Head, Czech Technical University in Prague
Head of the Process Control Department, ProTyS, a.s., Czech Hi-Tech Company

Techniques for modeling, identification, real-time control and supervision have been in the center of interest in many fields of industry for decades. Surprisingly, there are problems that have not been solved yet or there are new problems arising. The talk describes large industrial projects being solved in cooperation with academia and students of the Czech Technical University, Faculty of Electrical Engineering in particular. The presentation will give a summary of problems and techniques used in modeling, simulation and control in glass industry (glass furnaces a fiber-glass production), food industry (cheese production) and electrical power systems (maintaining stability of power generation, transmission and distribution in liberalized energy market). Large potential for high school and university students' involvement in such industrial projects and project-driven education will be discussed.

12:30 – 13:00 Panel Discussion

Panel discussion through interaction with the audience (Moderators: Professor Petr Horacek and Professor Zdenek Hanzalek)

13:00 – 14:00 JOINT LUNCH AND INFORMAL CHATS

14:00 – 14:45 Random Walk Around Some Stochastic Control Problems in Telecommunication, Finance and Medicine

Bozenna Pasik-Duncan
Professor
Mathematics Department and Information and Telecommunication Technology Centre
University of Kansas, Lawrence, Kansas , USA

The modern world is full of randomness and noise (Can we ignore noise?). This lecture will focus on modelling different types of noise in systems. We will take a random walk around some stochastic adaptive control problems in telecommunication and finance industries as well as in medicine, in particular epilepsy. We will observe that real world problems have become more and more complex



and have generated the need for development of new exciting stochastic calculus. We will conclude that the partnership of mathematics and control engineering, and collaborative effort in research are necessary for success in solving these problems.

14:45 – 15:30 Cooperative Driverless Vehicles

Ljubo Vlacic
Professor and Director
Intelligent Control Systems Laboratory
Griffith University, Australia

The idea of intelligent vehicles has brought with it promises of heightened safety, reliability and efficiency. No longer would the onus of responsible driving be placed on fallible humans, in fact, the very idea of a car crashing, or causing damage to someone would be completely alien and unthinkable. Congestion would entirely evaporate as computers took control of vehicles and decided the optimal route for greatest efficiency. While this seems extremely idealistic, there is an element of truth to these benefits that intelligent vehicle technologies can provide. Thanks to the most recent development of decision and control algorithms intelligent vehicles are now even capable of undertaking driving manoeuvres in cooperation with each other. This talk will address intelligent vehicle technologies and give examples of cooperative driverless vehicles for cities.

15:30 – 16:15 Robotics and Control

Richard Murray
Professor and Division Chair
California University of Technology, USA

This talk will use the Mars Exploratory Rovers (MER) and the DARPA Grand Challenge (autonomous desert racing) as an example to show how the ideas of feedback and dynamics arise in autonomous robotic systems. In both cases, humans must design machines that are capable of human-like decision making and movement in unknown environments.

16:15 – 16:30 Panel Discussion

Panel discussion through interaction with the audience (Moderators: Professor Petr Horacek and Professor Zdenek Hanzalek)

16:30 – 16:45 Wrap-up

Professor Bozenna Pasik-Duncan and Professor Ljubo Vlacic