PhysCon2013

Modeling and control of the underactuated mechanical systems

Schedule: Th-am1**,** 9:00- 10:00hrs
Auditorium: "Rafael Nieto" Rectory Building UASLP

Speaker: Professor RN Dr. Sergej Čelikovský

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Abstract:

Underactuated mechanical systems are those having less actuators than degrees of freedom. Therefore, their control requires intrinsically nonlinear techniques. Among them, various kinds of exact feedback linearizations and nonlinear decompositions are useful. Corresponding transformations often stem from an insight based on the knowledge from physics. As a consequence, this area serves as an excellent example of the natural interconnection of physics and control. The prominent role among underactuated mechanical systems play underactated walking robots, typically modeled as the n-link chain with (n-1) actuators between its links. The simplest underactuated system resembling the walking-like movements is the so-called Acrobot, called also as the biped or compass gait walker. As a matter of fact, it is possible to show via certain global system transformation and embedding technique that the control algorithms developed for the Acrobot may be directly extended to the case of a more general underactuated n-link. This technique may be also interpreted as the so-called virtual constraint technique using part of control inputs to impose suitable pre-selected additional virtual constraints. The purpose of this lecture will be to present the basic ideas from the underactuated mechanical systems control research and to briefly present the above mentioned exact feedback linearization and embedding techniques.

Short CV:

Sergej Čelikovský received his MSc. in Applied Mathematics in 1984 from Optimal Control Department, Moscow State University and his PhD. in Technical Cybernetics in 1988 from Academy of Sciences of the Czech Republic. He worked as the visiting researcher at University of Twente, Enschede, NL 1996; Department of Mechanical an Automation Engineering, Chinese University of Hong Kong 1998; and CINVESTAV del I.P.N., Mexico 1998-2000. Currently he works as the Senior Researcher and the Head of the Control Theory Department, Institute of Information Theory and Automation, Academy of Sciences of the Czech Republic. He is Full Professor at the Department of Control Engineering, Czech Technical University in Prague. He is member of IEEE since 1996, Senior Member of IEEE since 2002 and Chairman of Action Group "Chaos Control and Synchronization" of IEEE TC on Computer Aided Control Systems Design since 2004. His research interests include nonlinear systems, exact feedback linearization, stabilization, chaotic systems, output feedback control, underactuated mechanical systems and walking robots. S. Čelikovský is co-author of one book and two book chapters, co-editor of the book, he authored or co-authored over 40 papers in international journals, over 80 papers in international conference proceeding, resulting in over 1000 SCI citations (autocitations excluded). He served as the Subarea Chair of the IPC of the IFAC NOLCOS 2007 and 2010, as well as the member of IPC of other numerous international conferences. He has been member of IFAC TC on Nonlinear Systems since 1997 and its vice-chair during 1997-2002. Sergej Čelikovský served as the Associate Editor of: Dynamics of Continuous, Discrete and Impulsive Systems (2004-2006); IEEE Transaction on Automatic Control (2006-2009); currently, he is Member of Editorial Board of Kybernetika, Associate Editor of the Journal of Franklin Institute, IET Control Theory & Applications and International Journal of Bifurcation and Chaos.