Newsletter – June 2011

This is the EECI newsletter of June 2011. Topics of this issue are:

1. *EECI Graduate School on Control 2012: Program now available*
2. *Back to EECI Graduate School on Control 2011*
3. *Ulrich Münz: winner of the EECI PhD Award 2010*
4. *Call for EECI PhD Award 2011: extended deadline 15th July 2011*
5. *Latest news about HYCON2*
6. *WINPOWER: an ANR project led by EECI*
7. *FP7 Support Action BALCON*
8. *FP7 Support Action EUCLID*
9. *ICO-NEH : ratification of a new convention between 20 institutions*
10. *Post-doc position at University of California, Santa Barbara*
11. *PhD position at Supélec, south of Paris*
12. *Autoprox: toolbox for automatic approximation of nonlinear functions*
13. *Special issue of International Journal of Robust and Nonlinear Control: "New Directions on Hybrid Control Systems"*

If you wish to contribute (event, position, call, etc.) to the future EECI newsletter, please send the relevant information at chaillet AT ieee.org .

Best regards,

Antoine Chaillet

1. EECI Graduate School on Control 2012: Program now available

The 2012 edition of the EECI Graduate School will take place from February to May 2012. The program is available at www.eeci-institute.eu/EECI-docs2/EECI-Modules-2012.pdf. This year, 18 modules are proposed, among which 15 will be held at Supélec (south of Paris, France), 2 at Istanbul (Turkey) and 1 at L'Aquila (Italy). Each of these modules is programmed on one week (21 hours) and will be taught by a renowned expert of the domain. Participants may apply to financial support to cover travel and living expenses. The deadline for advanced registration is 16th of December 2011. Full information is available at www.eeci-institute.eu/GSC2012.

2. Back to EECI Graduate School on Control 2011

The 2011 edition of the EECI Graduate School on Control is now over. In total, 288 inscriptions have been made this year, which constitutes a constant number with respect to the 2010 edition. The 13 modules took place in Supélec (south of Paris, France between February and May 2010).

Participants are mostly PhD students and come from all around the world. 97 financial supports have been distributed to cover travel and living expenses, for a total amount of 46kE. The attribution of these scholarships has been made possible by the support of the research park Digiteo, the French Ministry of Research, and the GdR MACS.

We greatly thank all involved professors for the excellence of their courses, and the participants for their faithful presence. Special thanks to Eugénie Gouveia and Delia Visan for their crucial assistance in the organization of this yearly event.

We look forward to meeting you at the 2012 edition !

The organizers: F. Lamnabhi-Lagarrigue, E. Panteley, A. Chaillet

3. Ulrich Münz: winner of the EECI PhD Award 2010

Ulrich Münz will receive the 2010 EECI PhD Award on Control for Complex and Heterogeneous Systems for his work entitled: "Delay robustness on Cooperative Control" under the supervision of Frank Allgöwer, University of Stuttgart.

This price will be officially given at IFAC World Congress 2011 (Milan, Italy), during the Panel Session entitled "Energy and Environmental Challenges in Emerging Regions", to be held on Wednesday, August 31st from 16:00 to 18:00:

www.ifac2011.org/congress-program/panel-discussion/energy-and-environmental-challenges-in-emerging-regions

The full text of Ulrich Münz PhD thesis is available at:

www.ist.uni-stuttgart.de/~muenz/muenz_delay_robustness_in_cooperative_control.pdf

The list of all EECI PhD award winners since 2007 is available at

www.eeci-institute.eu/index.php?p=PhD-Award.

4. Call for EECI PhD Award 2011: extended deadline 15th July 2011

The EECI PhD Award is given annually, since 2007, in recognition of the best PhD thesis in Europe in the field of Control for Complex and Heterogeneous Systems. The aim is to encourage high-quality work amongst young researchers in their first research period. The prize consists of a certificate and a cash award of 1000 €.

The submission deadline is fixed at 15th June of each year. Exceptionally, a deadline extension has been done, and candidates are invited to apply before the **15th July 2011**.

To be eligible for the award, the thesis must have been defended in Europe during the year prior the above deadline. Candidates are required to submit the following documentation: copy of the thesis, extended four- to six- page summary of the thesis describing the study and the contribution to the knowledge in control theory, and, if applicable, connections to industrial practice, CV of academic and professional achievement, including a list of publications, a letter of recommendation from the advisor.

The applications are to be made through the EECI website:

www.eeci-institute.eu/PhD-Award/

Evaluation process: The members of the scientific committee are Alberto Bemporad, Antonio Bicchi, Francoise Lamnabhi-Lagarrigue, Antoine Chaillet and Christophe Prieur (chair). Each candidature will be independently evaluated by at least two designated senior researchers in the field. For each application, at least one review will be made by researchers that do not belong to the EECI PhD Award Committee.

The criteria for this evaluation are: theoretical approach and scientific quality, scientific impact for the area, number and quality of publications, industrial contacts, and possible other merits. Each reviewer will provide grades and comments on all of these aspects, and give a general recommendation on the candidature. Based on these evaluations, the EECI PhD Award Committee will designate the recipient of the award. The organizers reserve the right to divide the prize among several candidates.

For more information, please contact Christophe Prieur (Christophe.Prieur AT gipsa-lab.grenoble-inp.fr) or Antoine Chaillet (chaillet AT ieee.org).

5. Latest news about HYCON2

The FP7 NoE HYCON2 “Highly-complex and networked control systems” is proceeding according to its schedule. All latest news about HYCON2 can be found on its website:

www.hycon2.eu

The FP7 NoE HYCON2, started in September 2010, is a four-year project coordinated by Françoise Lamnabhi-Lagarrigue.

It aims at stimulating and establishing a long-term integration in the strategic field of control of complex, large-scale, and networked dynamical systems. It focuses in particular on the domains of ground and aerospace transportation, electrical power networks, process industries, and biological and medical systems.

6. WINPOWER: an ANR project led by EECI

EECI is the leading partner of the recently launched project WINPOWER: "Wind energy Integration by DC Network". This project, funded by the French Agency for Research (ANR) for a total duration of 48 months, involves 9 partners from both academic and industrial institutions.

WINPOWER aims at developing a wide control strategy to manage large-scale High Voltage Direct Current (HVDC) multi-terminal networks that will interconnect renewable energy sources (RES) to the main power network. Proposed work deals with control strategies in a wide sense, from off-line optimization of network itself before its construction; to real time, multi layered, decentralized stabilizing control that is embedded into its components. This DC grid will allow for multi-RES generators efficient interconnection, for example offshore Wind Farms (WF) and solar plants. This DC grid will also manage their connection to: the main AC grid; large loads (big cities or industrial facilities); other DC grids like a future European SuperGrid.

Northern Europe's RES will likely be implemented through the "Baltic interconnection", integrating offshore wind farms using DC networks. But most HVDC links are bi-terminal (one sending and one receiving). Moving forward, this will economically and technically lead to an under-optimal scheme, therefore leading to prefer migration toward multi-terminal DC networks. However scientific and technical literature did not yet solve voltage and power quality control on multi-terminal DC networks. Solving such problems requires a complete new system thinking and testing, bringing together industry and utility players from generation and transmission as well as academic research that brings theoretical support to platform experimentations.

The project will show how stability can be obtained with already used technology such as high voltage direct current (DC) equipments and systems, or AC/ DC mixed systems and networks. Such a design requires a lot of experience and adjustments, as well as conventions as to what to control, what "gridcodes" to transmit across networks, and what local autonomy level to accept without putting the entire grid at risk. In return, systems connected on both sides of a point of common coupling need to implement technologies that can correctly process information and power according to predefined gridcodes and conventions.

To obtain these objectives, new control schemes are envisaged to cope with large-scale networked power systems issues like delayed remote information, uncertainties, interconnected nonlinear dynamics and mixed time scales. It will allow players along the value chain to position products and service offers according to their specific know-how

and business models. As a consequence, a broad decentralized and intercommunicating strategy is necessary to target building a global European HVDC system infrastructure.

For more information: www.eeci-institute.eu/WINPOWER

7. FP7 Support Action BALCON

EECI is partner of the recently accepted FP7 Support Action BALCON "Boosting EU – Western Balkan Countries research collaboration in the monitoring and control area". The project aims at reinforcing the cooperation between European Union and Balkan Countries.

8. FP7 Support Action EUCLID

EECI is a partner of the FP7 Support Action EUCLID "Strengthening EU-India collaboration in networked monitoring and control systems technologies". Started on the first of June 2010, the ambitious 2-years EUCLID project aimed at stimulating cooperation in the networked monitoring and control system technologies between Europe and India, in order to support Europe's leading position in monitoring and control while ensuring mutual benefits for both Europe and India. Consequently, EUCLID aims to develop cooperation in monitoring and control methods and tools that are relevant to the research priorities identified in the FP7 ICT Work Programme 2009 and that ensured mutual benefits. These research priorities include the following:

- Foundation of Complex Systems Engineering: to develop novel scalable methods for sensing, control and decision-making, to achieve robust, predictable and self-adaptive behavior for large-scale networked systems;

- Wireless Sensor Networks and Cooperation Objects: to develop architectures, hardware/software integration platforms and engineering methods for distributed systems composed of heterogeneous networked smart objects;

- Control of Large-Scale Systems: to enable optimal operation of large-scale dynamic systems through proactive process automation systems applicable across several sectors, going far beyond what current SCADA and DCS/PLC can deliver today…

In order to stimulate the monitoring and control cooperation, EUCLID's mission is threefold:

(i) map Indian organisations involved in research relevant to the EU's priorities concerning monitoring and control methods and tools, assess the potential for monitoring and control collaboration between India and Europe, and propose recommendations with a roadmap and an action plan;

(ii) organise combined awareness-raising, networking & brokerage and training events in India and in Europe concerning relevant monitoring and control calls under FP7 ICT, and a delegation tour of European specialists to Indian organizations, and reinforce the attendance of Indian experts at key monitoring and control events in Europe;

(iii) provide 'hands-on' support to Indian monitoring and control organisations to strengthen Indian participation in the European research and training: joining European consortia preparing FP ICT proposals, facilitating secondment of Indian researchers to European monitoring and control organizations , and facilitation access to European Technology Platforms and networks.

The International Expert Group –10 top level highly motivated specialists– will provide their expertise to project implementation and assistance to the development of long term monitoring and control collaborations between Europe and India.

Latest information about this project and periodic newsletters can be found on EUCLID's website: www.euclid-india.eu

9. ICO-NEH : ratification of a new convention between 20 institutions

The International Curriculum Option (ICO) was started in January 2006 to provide a common cultural and academic substrate in the field by establishing a network of institutions that impose common supplementary criteria for the participating PhD students, in addition to those of their already-existing doctoral programs.

A new convention has recently been signed between 19 academic partners: Università de L'Aquila, Technische Universität Berlin, Ruhr Universität Bochum, Università di Cagliari, DISC – Dutch Institute of Systems and Control (including Delft University of Technology, Eindhoven University of Technology, University of Twente, CWI Amsterdam, University of Groningen), Universität Dortmund, Institut Polytechnique de Grenoble, Institut National Polytechnique de Lorraine, Lunds Universiteit, Politecnico di Milano, Supélec, Université Paris-Sud 11, University of Patras, Università di Pavia, Université de Rennes 1, Universidad de Sevilla, Università di Trento, Universidad de Valladolid, and Università di Pisa.

ICO offers a course of specialized study in hybrid systems for those students already enrolled in a PhD program at one of the participating host Institutions. Participants are required to fulfill specific career requirements in order to be granted ICO certification. PhD students that apply to this program (which is open to students of all Universities, based only on curricular qualifications) are required to spend two periods of several months in a foreign partner institution and to follow common PhD schools and seminars taught by world leader experts.

10. Post-doc position at University of California, Santa Barbara

A postdoctoral position is available in the Department of Mechanical Engineering at the University of California, Santa Barbara. This Nation Science Foundation-funded position is on the topic of Controlling Populations of Neurons. The tasks will involve the development of a feedback control method for randomizing the phase of oscillatory neurons, work which is motivated by deep brain stimulation treatment of Parkinson's Disease. This project will likely include computer simulations using Graphics Processing Units (GPUs). Expertise in mathematical neuroscience, control theory, and/or scientific computation is a plus.

Applications should be emailed to Professor Jeff Moehlis (moehlis AT engineering.ucsb.edu). The applicant should provide the names and contact information for three professors who are familiar with their background.

The appointment will be for one year, with a possibility of reappointment, subject to performance and availability of funds.

11. PhD position at Supélec, south of Paris

Contributed by A. Chaillet, chaillet AT ieee.org

Subject of the thesis: Development of desynchronizing and destabilizing strategies for nonlinear dynamical systems, with application to neurosciences

Application deadline: 1st of July 2011

CONTEXT: This PhD thesis will be part of a more extensive attempt aiming to adapt some Control Theory methodologies to the field of neurosciences. The development of formal results, based on dynamical models, allows both a better understanding of some neurological phenomena and progresses in therapeutic treatments. In particular, the objective of this PhD thesis is to extend and formalize some recent results in synchronization/deynchronization to advanced models of neurons, presenting richer dynamics and more biological relevance. Neuronal synchrony is indeed involved in many brain functions, but can also lead to pathological symptom (such as Parkinson disease or epilepsy). The fundamentally complex behavior of neuronal populations (dimension, interconnection, heterogeneity, time scales, parameter sensitivity,…) imposes the use of new analysis methods inspired from related domains involving stability analysis of interconnected nonlinear systems, analysis of hybrid dynamics and robust control.

This work will take place in the Framework of the FP7 Network of Excellence, managed by F. Lamnabhi-Lagarrigue (L2S), HYCON2 : « Highly-complex and networked control systems » (23 partner universities), which devotes an entire chapter to the development of analysis and control methods for neurosciences. The recruited PhD student will work among the control engineers and applied mathematicians of L2S, and with other PhD students involved in related topics. These studies will be at the core of the exploratory project PEPS TREMBATIC : « Control engineering and electrical stimulation : toward realistic control laws for pathological tremor attenuation » financed by the French Council of Scientific Research (CNRS, INSIS) and coordinated by A. Chaillet ; this project develops a partnership between the L2S, the LIRMM, the reeducation centre PROPARA and the Hospital of Montpellier. A tight interaction with the team of Prof. Palfi, neurosurgeon and neurophysiologist at Créteil Hospital and URA CEA-CNRS is also expected.

BRIEF SCIENTIFIC DESCRIPTION: Deep Brain Stimulation (DBS) is a treatment used to reduce some symptoms of common neurological diseases : it relies on a permanent electrical stimulation of some cerebral zones, through implanted electrodes, to desynchronize targeted neuronal populations. Recent developments of our research team have led to a better insight of the mechanisms involved in this neuronal desynchronization and are currently yielding the development of closed-loop control

laws able to desynchronize the behavior of these cells in a more efficient way than the (open-loop) signals currently used by physicians. The aim of this PhD thesis is to extend the desynchronization methodology developed in the framework of DBS to wider classes of nonlinear systems. The desynchronization objective will be formalized as the destabilization of the dynamics ruling the difference between the systems behaviors. The objective is to obtain rigorous analytical conditions and to design control laws under which desynchronization is guaranteed between the nonlinear dynamical systems involved. These control laws will first be developed by relying on the whole state of the systems, and then by exploiting only an output measurement. While a huge literature exists on synchronization of nonlinear systems, there are still few results regarding desynchronization without relying on chaotification techniques. Particular attention will be paid to the validity of the obtained results under exogenous disturbances, measurement noise and uncertainty.

Candidates profile: While aiming at practical fallouts, the developments expected from this PhD thesis are mostly of a theoretical nature. Interest and skills in basic mathematics are necessary. Some background in control theory is also desired; knowledge in nonlinear control would be welcome. The ability to work in a team and the interest in multidisciplinary interaction (physics, biology, medicine,...) are requested. Skills in simulation software would be appreciated. Knowledge of French language is not required, but an appropriate level of English is necessary.

Skills developed during the PhD: Beyond gaining a good knowledge of stabilizing control methodologies, this work will make the recruited PhD student develop both a great autonomy and the ability to interact with colleagues inside and outside the domain. In addition, the scientific network of L2S and regular visits from renowned researchers will contribute to the establishment of fruitful connections.

12. Autoprox: toolbox for automatic approximation of nonlinear functions

Contributed by: Michal Kvasnica and Alexander Szucs (Slovak University of Technology in Bratislava, Slovakia)

Autoprox is a Matlab toolbox for deriving optimal piecewise affine (PWA) approximations of arbitrary multivariable nonlinear functions given in their analytic form. Continuous PWA approximations minimizing the approximation error are obtained by standard optimization techniques. This basic building block can also be employed to automatically derive a PWA approximation of generic nonlinear dynamical models. The obtained approximate model is then expressed as a hybrid system which involves logic switches. Autoprox then automatically translates such a model description into the HYSDEL language for further processing and control synthesis. The whole approximation procedure is fully automatic and easy to use through command-line and graphical user interfaces. The toolbox is freely available under the GPL open-source license from www.kirp.chtf.stuba.sk/~sw.

13. Special issue of International Journal of Robust and Nonlinear Control: "New Directions on Hybrid Control Systems"

Guest editors: Christophe Prieur and Sophie Tarbouriech

Content:

* Editorial, by Christophe Prieur and Sophie Tarbouriech

* Estimation problems for a class of impulsive systems (pages 1066–1079), by L. Belkoura, T. Floquet, K. Ibn Taarit, W. Perruquetti and Y. Orlov

* Robust finite-time stability of impulsive dynamical linear systems subject to norm-bounded uncertainties (pages 1080–1092), by F. Amato, R. Ambrosino, M. Ariola and G. De Tommasi

* Discrete-time control for switched positive systems with application to mitigating viral escape (pages 1093–1111), by Esteban Hernandez-Vargas, Patrizio Colaneri, Richard Middleton and Franco Blanchini

* Alternative control methods for DC–DC converters: An application to a four-level three-cell DC–DC converter (pages 1112–1133), by Diego Patino, Mihai Bâja, Pierre Riedinger, Hervé Cormerais, Jean Buisson and Claude Iung

* Analytical and numerical Lyapunov functions for SISO linear control systems with first-order reset elements (pages 1134–1158), by Luca Zaccarian, Dragan Nešić and Andrew R. Teel

*Anti-windup strategy for reset control systems (pages 1159–1177), by Sophie Tarbouriech, Thomas Loquen and Christophe Prieur

* Stabilization for a class of minimum phase hybrid systems under an average dwell-time constraint (pages 1178–1192), by A. R. Teel and L. Marconi

* Observer-based control of linear complementarity systems (pages 1193–1218), by W. P. M. H. Heemels, M. K. Camlibel, J. M. Schumacher and B. Brogliato

* Robust output stabilization: Improving performance via supervisory control (pages 1219–1236), by D. Efimov, A. Loria and E. Panteley

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