■ Le LAAS est un laboratoire de recherche du CNRS (Département ST2I) dans le domaine des Sciences et Technologies de l'Information, de la Communication et des Systèmes.

Il est associé à trois établissements d'enseignement supérieur : l'Université Paul Sabatier, l'Institut National des Sciences Appliquées et l'Institut National Polytechnique de Toulouse. Il a reçu le label Carnot en 2006.

Il regroupe 600 personnes, dont près de 250 chercheurs et enseignants-chercheurs, autant de doctorants et post-doctorants, et plus de 100 ingénieurs, techniciens et personnels administratifs.

Ses thématiques menées par 18 groupes de recherche couvrent les pôles suivants :

- Micro et Nano Systèmes (MINAS)
- Modélisation, Optimisation et Conduite des Systèmes (MOCOSY)
- Robotique et Intelligence Artificielle (RIA)
- Systèmes Informatiques Critiques (SINC)

■ *LAAS is a laboratory of the French National Center for Scientific Research (CNRS), within the department of Information and Engineering Sciences and Technologies.*

It is associated to the University of Toulouse: Université Paul Sabatier, Institut National des Sciences Appliquées and Institut National Polytechnique. The lab has been labelled «Carnot Institute» in 2006.

It hosts 600 workers, among which 250 research scientists and faculty members, 250 PhDs and postdocs, and 100 engineers, technicians and administrative staff.

With 18 research groups, its topics cover the following areas :

- *Micro and Nano Systems (MINAS)*
- *System Modelling, Optimization and Control (MOCOSY)*
- *Robotics and Artificial Intelligence (RIA)*
- *Critical Computer Systems (SINC)*

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Laboratoire d'Analyse et d'Architecture des Systèmes du CNRS

Forum de prospective internationale en Sciences et Technologies de l'Information, de la Communication et des Systèmes

Perspectives in Information, Communication and Systems Sciences & Technologies

Programme

Vendredi 9 novembre 2007
de 8 h 30 à 17 h 15
LAAS-CNRS - Salle de Conférences

LAAS CNRS

8:30 Accueil

8:45 Introduction Direction du LAAS-CNRS

9:00 «Trusted ILLIAC: A Configurable Hardware Framework for Reliability and Security»,
Ravishankar K. Iyer, University of Illinois at Urbana-Champaign, USA

9:45 «Privacy-Enhanced Ambient Intelligence»,
Yves Deswarte, LAAS-CNRS

10:15 *Pause*

10:30 «Fault Tolerant Control: Present and Future»,
Jan Lunze, Ruhr-University Bochum, Allemagne

11:15 «Solving Global Optimisation Problems over Polynomials with GloptiPoly»,
Didier Henrion, LAAS-CNRS

11:45 «From MEMS to NEMS: Challenges and Opportunities for Low Power Applications»,
Adrian M. Ionescu, EPFL, Suisse

12:30 «Chips for Life: Microfluidics for Advanced Diagnostics»,
Emmanuel Delamarche, IBM, Suisse

13:15 *Déjeuner*

14:45 «Micro and Nanosystems at LAAS : Which Technologies for Today and Tomorrow?»,
Anne-Marie Gué, LAAS-CNRS

15:15 «Challenges and Solutions in Cognitive Systems»,
Henrik I. Christensen, Georgiatech, USA

16:00 «Human-Robot Interaction : A New Challenge»,
Rachid Alami, LAAS-CNRS

16:30 Table ronde

17:15 Clôture de l'évènement

16:00 «Human-Robot Interaction: A New Challenge»
Rachid Alami, LAAS-CNRS

Interaction with human is a key issue and a major challenge for a large number of prospective robot uses.

We are conducting research toward the construction of a cognitive robots able to act in close interaction with humans and to serve as a companion in their daily life.

I will present several results developed in COGNIRON, a collaborative research project funded by the European Commission in the framework of the 'Beyond Robotics' workprogramme.

Cogniron research teams contribute to the study of the perceptual, representational, reasoning and learning capabilities of embodied robots in a human centred perspective.

More particularly, I will focus on issues that involve decisional interaction between a human and a robot that acts and moves in his close vicinity.

Rachid Alami is Senior Scientist at LAAS-CNRS. He received an engineer diploma in computer science in 1978 from ENSEEIHT, a Ph.D in Robotics in 1983 from the University Paul Sabatier (Toulouse, France) and a «Habilitation à diriger des recherche» in 1996.

He contributed and took important responsibilities in several national, European and international research and/or collaborative projects (EUREKA, ESPRIT, IST).

His main research contributions fall in the fields of Robot Control Architectures, Task and motion planning, manipulation, multi-robot cooperation, human-robot interaction, and more generally robot decisional autonomy. He has also a substantial experience in robotics system integration and transfer operations.

15:15 «Challenges and Solutions in Cognitive Systems»
Henrik I. Christensen, Georgiatech, USA

Artificial Cognitive Systems is the study of embodied systems that can perceive, represent, acquire and reason about their own and others activities in the world to enable goal achievement. The design of systems that are truly cognitive would be a major departure from how IT systems are designed, implemented and utilized today. At the heart of this problem are system organization and representations that facilitate communication, generalization, learning, reasoning and fusion. At the same time to be meaningful these systems must be embedded in the real world and as such be faced with the richness and diversity of the external environment.

To study such systems there is a need for a multi-disciplinary approach that allows holistic consideration of all the aspects across systems theory, AI, perception, statistical models, language theory and formal methods. In this presentation a number of general challenges for cognitive systems are outlined and some possible solutions will also be discussed.

Henrik I. Christensen, is the KUKA Chair of Robotics and a Professor of Computing with the Georgia Institute of Technology. He also served as the director of the Center for Robotics and Intelligent Machines. Dr. Christensen was initially trained in Mechanical Engineering and worked subsequently with MAN/B&W Diesel. He earned M.Sc. and Ph.D. EE degrees from Aalborg University, 1987 and 1990, respectively.

Upon graduation Dr. Christensen has participated in a large number of international research projects across 3 continents. He has held positions at Aalborg University, Oak Ridge National Laboratory, and Royal Institute of Technology before joining Georgia Tech.

Dr. Christensen does research on robotics with a particular emphasis on a systems perspective to the problem. Solutions must have a strong theoretical basis, a corresponding well-defined implementation and it must be evaluated in realistic settings. There is a strong emphasis on «real systems for real applications». The research has involved collaborations with ABB, Electrolux, Daimler-Chrysler, KUKA, iRobot, WEDA, Apple, Partek Forest, Volvo, SkogForsk, SAIC, ...

Dr. Christensen has published more than 250 contributions across robotics, vision and artificial intelligence.

9:00 «Trusted ILLIAC : A Configurable Hardware Framework for Reliability and Security»
Ravishankar K. Iyer, University of Illinois at Urbana-Champaign, USA

Trusted ILLIAC is a reliable and secure computing platform being built at the University of Illinois Coordinated Science Laboratory (CSL) and Information Trust Institute (ITI), involving faculty from Electrical and Computer Engineering and Computer Science Departments. The end goal is a large, demonstrably trustworthy enterprise-class computing system to support, what is variously referred to as on-demand/utility computing or adaptive enterprise-computing Such systems require that a significant number of applications co-exist and share hardware/software resources using a variety of containment boundaries. Current solutions aim at providing hardware and software solutions that can only be described as one-size-fits-all approaches. Today's environments are complex, expensive to implement, and nearly impossible to validate.

The challenge is to provide an application-specific level of reliability and security in a totally transparent manner, while delivering optimal performance. A promising approach lies in developing a new set of application-aware methods that provide customized levels of trust (specified by the application) enforced in hardware, using an integrated approach involving reprogrammable hardware, enhanced compiler methods to extract security and reliability properties. Our approach is to demonstrate such a set of integrated techniques that span entire system hierarchy: processor hardware, operating system, and application. This talk will describe the current status, the prototype hardware and software and on-going plans.

Trusted ILLIAC is based on research and support provided by, among others, The National Science Foundation, MARCO/GSRC (SRC and DARPA), IBM, HP, AT&T, AMD, Intel, Motorola, XILINX, and the State of Illinois.

Ravishankar K. Iyer is the director of the Coordinated Science Laboratory (CSL) at the University of Illinois at Urbana-Champaign, where he is a George and Ann Fisher Distinguished Professor of Engineering. He holds appointments in the Department of Electrical and Computer Engineering and the Department of Computer Science. His research interests are in the areas of dependable and secure systems. He has been responsible for major advances in the design and validation of dependable computing systems. His research focuses on methods and techniques for designing secure and fault-tolerant networked systems and applications. He currently heads the TRUSTED ILLIAC: a large machine-building project at Illinois demonstrating application-aware reliable and secure computing.

Dr. Iyer has a broad outreach to industry and government, both nationally and internationally, having worked with several major vendors over the years. He is a fellow of the IEEE and the ACM, and an associate fellow of the American Institute for Aeronautics and Astronautics (AIAA). He has received several awards including the Humboldt Foundation Senior Distinguished Scientist Award for excellence in research and teaching, the AIAA Information Systems Award and Medal for "fundamental and pioneering contributions towards the design, evaluation, and validation of dependable aerospace computing systems," and the IEEE Emanuel R. Piore Award "for fundamental contributions to measurement, evaluation, and design of reliable computing systems."

9:45 «Privacy-Enhanced Ambient Intelligence»
Yves Deswarte, LAAS-CNRS

New technologies, including those related to ambient intelligence, tend to offer attractive services at a low cost to a large public. But they may also raise privacy concerns that could impede their deployment. Moreover, some trends in security technologies (e.g., traceability and strong authentication) can be seen as threats for the privacy of customers or citizens. It is thus necessary to take these concerns into account when designing new ambient intelligence applications so that they can be secure while preserving privacy.

In this talk, two main privacy principles will be established, on personal data minimization and sovereignty. Then the classes of privacy-related risks will be presented, with some examples of how they can be reduced by integrating Privacy-Enhancing Technologies (PETs) into ambient intelligence scenarios, but also how small personal devices can help to implement PETs.

Yves Deswarte is currently a Research Director of CNRS, member of the «Dependable Computing and Fault Tolerance» research group at LAAS-CNRS in Toulouse, France. Successively at CII, CIMSA, INRIA and LAAS, his research work has dealt mainly with fault-tolerance and security in distributed computing systems. Recently, his main research interests were in intrusion tolerance, quantitative security evaluation, dependability evaluation criteria, protection of safety-critical systems with multiple levels of integrity, flexible security policies, and privacy-preserving authorization schemes. He is the author or co-author of more than 100 international publications in these areas. He has been consultant for several organizations in France and for SRI-International in the USA. He has been a member of many international conference program committees and has chaired several of them. He is a senior member of SEE, a member of the IEEE TC on Security and Privacy and a member of the ACM SIGSAC. He is representing the IEEE Computer Society at IFIP TC-11 (Technical Committee on Security and Protection in Information Processing Systems).

14:45 «Micro and Nanosystems at LAAS: Which Technologies for Today and Tomorrow?»
Anne-Marie Gué, LAAS-CNRS

LAAS is involved in Micro and Nanotechnologies since the sixties when the laboratory started to work on bipolar and MOS-transistors, supporting technological developments in close connection with microelectronics companies. Now, the research activities in micro-nano technology are multidisciplinary including a wide range of microsystems, from power electronics to MEMS, MOEMS and bio MEMS. This evolution has been accompanied with the introduction of specific technologies such as silicon micromachining or assembly technologies. The growing demand in biomedical applications as well as in autonomous and distributed systems makes necessary to open new manufacturing ways, combining low cost and large surface technologies with multiscale and heterogeneous integration. These perspectives are highly challenging and there is no doubt that micro and nanotechnologies developed at LAAS will have to face a major evolution in the forthcoming years.

Anne-Marie Gué studied physics at the National Institute for Applied Science and received her PhD degree at the University of Toulouse. She joined LAAS-CNRS in 1988 as a CNRS senior scientist. Since 1994, she is involved in the development of microtechnologies and microsystems for chemical and biological applications. She has first been working in the design and fabrication of miniaturised chemical and bio-sensors. The results of these researches have been transferred to the company Neosens which she has contributed to create. Her activity is now focusing on microfluidic aspects. She has been the head of the Microsystem and System Integration Group at LAAS-CNRS from 1999 to 2006.

12:30 «Chips for Life: Microfluidics for Advanced Diagnostics»

Emmanuel Delamarche, IBM, Suisse

The involvement of nanotechnology in biology and analytical sciences provides tantalizing opportunities to miniaturize biosensing platforms for applications in diagnostics, biotechnology, pharmaceutical research, and research in life sciences at large. Unfortunately, the challenge of handling small volumes (<1 µL) of solutions and the difficult preparation of high-quality binding sites for analytes constitute two important bottlenecks for miniaturizing analytical platforms. I will present some work on microfluidics, where sub-microliter quantities of aliquots can be displaced over surfaces using “simple” capillary forces, either sequentially or in parallel. An essential feature of these microfluidics is the possibility to reversibly seal them on a surface, or even to displace them over a surface in a non-contact mode, both while working in air or under immersed conditions if desired. Such microfluidics can be used to miniaturize surface fluorescence immunoassays to unprecedented levels and to steer microjets of liquid over surfaces so as to locally form gradients of proteins on surfaces, or to manipulate single adherent cells.

Emmanuel Delamarche is currently leading activities on Experimental Biosciences in the IBM Zurich Research Laboratory with the goal of developing expertise in microtechnology, surface chemistry and biochemistry for solving important problems in biology and medicine. Emmanuel’s expertise covers self-assembly, soft lithography, miniaturized biological assays based on microfluidics, and nanotechnology in general. He sometimes acts as a research expert for IBM task forces, for consulting engagements, or to review academic and governmental research projects. Emmanuel studied organic and inorganic chemistry and received a degree in supramolecular chemistry in 1992 from the University Paul Sabatier of Toulouse in France. He received a Ph.D. in biochemistry in 1995 from the University of Zurich, for work done at IBM. He has then been a Research Staff Member in the microcontact processing project until 2003, and then in the nanoscale structures and devices project of the Zurich Laboratory. He has co-authored ~80 publications, several book chapters, reviews and over 20 patents. He has received 6 awards from IBM for his work and inventions, has been named “Master Inventor” in 2003 by IBM, and received the Werner prize of the Swiss Chemical Society in 2006.

10:30 «Fault Tolerant Control: Present and Future»

Jan Lunze, Ruhr-University Bochum, Allemagne

Fault-tolerant control aims at a graceful degradation of the behaviour of automated systems in case of faults. It satisfies the industrial demand for enhanced availability, in contrast to traditional reactions to faults that bring about sudden shutdowns.

The talk surveys the current methods of fault diagnosis and control re-design after the fault occurrence. It shows the common idea of diagnostic methods for continuous and discrete-event systems and describes controller re-design methods for reconfiguration problems that occur after sensor and actuator failures have brought the control loop out of operation. Application examples show the effectiveness of these methods. New application areas like complex systems with distributed structure or networked system require the elaboration of advanced theoretical foundation of fault tolerant-control, which will be outlined.

Jan Lunze obtained the the PhD and the DrSc. degrees (Habilitation) both from the Technical University Ilmenau in 1880 and 1983. Between 1992 and 2001 he was Professor of Control Engineering at the Technical University Hamburg-Harburg. Now he is Professor of Automatic Control and head of the Institute of Automation and Computer Control at the Ruhr-University Bochum where he teaches system and control theory.

His research interests are in linear control theory, particularly in the fields of robust control, large-scale systems and networked control systems, in hybrid dynamical systems, in discrete-event systems and in applications of knowledge processing to dynamical systems. Currently, his research is focused on qualitative modelling, fault diagnosis, with applications to automotive systems and in the process industry. He is author and co-author of numerous research papers and has written several monographs including «Robust Multivariable Feedback Control» (Prentice- Hall 1988), «Feedback Control of Large-Scale Systems» (Prentice-Hall 1992) «Diagnosis and Fault-Tolerant Control» (with Blanke, Kinnaert and Staroswiecki, Springer 2006) and the German textbooks «Regelungstechnik» (Springer, several editions since 1996) and «Ereignisdiskrete Systeme» (Oldenbourg 2006).

11:15 «Solving Global Optimisation Problems over Polynomials with GloptiPoly»

Didier Henrion, LAAS-CNRS

We describe the main features of GloptiPoly, a freeware building and solving convex relaxations of non-convex multivariate polynomial optimisation problems. The software generates a series of bounds whose monotonic convergence to the global optimum can be proved thanks to recent resultsfrom real algebraic geometry, functional analysis and measuretheory. Numerical experiments show that for most of the small-and medium-scale problems described in the literature, the global optimum is reached at low computational cost.

Didier Henrion received an Engineer's Degree from INSA Toulouse in 1994, a PhD Degree from the Czech Academy of Sciences in 1998 and a PhD Degree from INSA Toulouse in 1999, all in the area of systems control theory. Since 2000 he has been a CNRS researcher at LAAS-CNRS, with a secondary appointment as a researcher at the Czech Technical University in Prague. In 2004 he was awarded the Bronze Medal from CNRS.

His research interests include numerical algorithms for polynomial matrices, convex optimization over linear matrix inequalities, robust multivariable control and computer-aided control system design .

11:45 «From MEMS to NEMS: Challenges and Opportunities for Low Power Applications»

Adrian M. Ionescu, EPFL, Suisse

This presentation will focus on the new functionality and low power opportunities resulting from the use of CMOS-MEMS/NEMS hybrid platforms or hybrid NEM-FET devices.

The talk will be illustrated with both simulation and fabrication examples of above-IC and in-IC applications of MEM passives, resonators and switches. A particular attention will be dedicated to low power abrupt NEM switches and memories.

Adrian M. Ionescu is an Associate Professor at the Swiss Federal Institute of Technology, Lausanne, Switzerland. He received the B.S./M.S. and Ph.D. degrees from the Polytechnic Institute of Bucharest, Romania and the National Polytechnic Institute of Grenoble, France, in 1989 and 1997, respectively. He has held staff and/or visiting positions at LETI-CEA, Grenoble, France, LPCS-ENSERG, Grenoble, France and Stanford University, USA, in 1998 and 1999.

His research interests focus on micro- and nano-electronic devices aimed at Integrated Circuit design - especially process development, modeling and electrical characterization. His research group is working on various subjects in the field of silicon micro/nano-electronics with special emphasis on Beyond-CMOS nanoscale solid-state devices and their applications and RF MEMS/NEMS for in- and above-IC integration.

Dr. Ionescu has published more than 100 articles in international journals and conferences. He received three Best Paper Awards in international conferences and the Annual Award of the Technical Section of the Romanian Academy of Sciences in 1994. He served in the ISQED and IEDM conference technical committees in 2003 and 2004 and he was the Technical Program Committee Chair of ESSDERC in 2006.

He is director of the Laboratory of Micro/Nanoelectronic Devices (LEG-2) and also served as Director of the Institute of Microelectronics and Microsystems of EPFL from 2002 to 2006. He is a consulting expert for the IST program of the European Commission in Brussels since 1999 and is appointed as national representative of Switzerland for the European Nanoelectronics Initiative Advisory Council (ENIAC).