Regional Program STIC-AmSud
2016 Project Proposal (Research – Innovation)

Basic Form

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A. General Information

A1	**Project title**
	Control of Dynamical Systems under Communication Constraints

A2	**Acronym**
	CoDySCo2

A3	**Research domain**
	Control Systems

A4	Project goals
	The general objective of the present project is the development of formal analysis and design methods for dynamical systems operating over communication networks. In the analysis context, the methods should provide efficient computational tools to assess stability and performance of closed-loop systems in the presence of communication delays, aperiodic sampling, data packet losses and signals quantization. These tools must be able to quantify admissible delays, maximal inter-sampling intervals and quantization coarseness for which stability of closed-loop systems is preserved and performance degradation is kept under admissible levels. On the other hand, regarding the design, methods should be take explicitly into account for, during the control law design, the communication delays, the number of bits for coding information, data losses and aperiodic sampling in order to satisfy stability and performance requirements. More specifically, the following sub-problems should be treated: control subject to aperiodic sampling and communication delays; event-triggered control; control subject to quantized information, and fundamental limitations for asynchronous sampled systems. In parallel, the project aims also at interchanging experiences and techniques among the participants, involving students (PhD. and M. Sc.) and post-docs in research and developments as well as generating joint publications in international journals and conferences

A5	Abstract
	This project focuses on the development of methods and techniques for analysis and design of dynamical control systems to cope with constraints induced by communication constraints between sensors, actuators and dynamical plants. The motivation for this study comes from the fact that most of control systems operates over a communication network (the so-called networked control) or involves traffic of information over a communication channel. In this scenarios, the effects of communication delays, packet losses, heavy

	temporary load of computation in a processor, aperiodic sampling, battery consumption (e.g when wireless communication is concerned) and data quantization, must be take into account in the closed-loop systems. Neglecting these communication- induced constraints can lead to considerable performance degradation or even unstable behaviors, with economic or catastrophic consequences. The main goals of this project concern the proposition of new methods and techniques of analysis and control design in order to cope with the aforementioned communication constraints. In the analysis context, the methods should provide efficient computational tools to assess stability and performance of closed-loop systems in the presence of communication delays, aperiodic sampling, data packet losses and signals quantization. These tools must be able to quantify admissible delays, maximal inter-sampling intervals and quantization coarseness for which stability of closed-loop systems is preserved and performance degradation is kept under admissible levels. Regarding the synthesis, methods should take explicitly into account for, during the control law design, the communication delays, the number of bits for coding information, data losses and aperiodic sampling in order to satisfy stability and performance requirements. To achieve these goals the methodology will be based on appropriated models of the dynamic systems (linear and nonlinear) as well as of the communication phenomena (delays, packet losses, quantization, aperiodic sampling, etc.). The theoretical developments will be based on the Lyapunov theory for linear, nonlinear and hybrid systems. Stability and performance results should be formulated mainly as linear matrix inequalities allowing to cast them in convex optimization problems aiming to compute maximum allowable delays and sampling intervals to ensure the stable behavior, compute minimal number of bits to guarantee stability and a certain performance, estimate regions of attraction (for nonlinear systems), or even, compute the controller parameters in order to maximize the admissible delays, reduce control updating (in event-trigger strategies, for instance), maximize the region of attraction, among other optimization criteria.

A6	Scientific coordinators at each institution			
	South America A		**South America B**	
	Institution	Universidade Federal do Rio Grande do Sul (UFRGS)	Institution	Universidad de Concepcion (UC)
	Project coordinator	Prof. João Manoel Gomes da Silva Jr.	Project coordinator	Prof. Daniel Sbarbaro Hofer
	Address	Departamento de Sist. Elétricos de Automação e Energia Av. Osvaldo Aranha 103, Porto Alegre-RS BRASIL	Address	Departamento de Ingeniaria Eléctrica Campus Conception, Victor Lamas 1290, Casilla 160-C, Conception, Octava Region CHILE
	Phone/Fax	(+55 51) 3308-3140/ 3308- 3293	Phone/Fax	(+56 41) 220 4000/ 222 7455
	Email	jmgomes@ufrgs.br	Email	dsbarbar@udec.cl
	South America C		**South America D**	
	Institution	Centro Federal de Educação Tecnológica de Minas Gerais (CEFET-MG)	Institution	UNICAMP
	Project coordinator	Prof. Valter Júnior de Souza Leite	Project coordinator	Prof Pedro Luis Dias Peres
	Address	Departamento de Engenharia Mecatrônica Campus Divinópolis R. Alvares Azevedo, 400 35503-822 Divinópolis – MG BRASIL	Address	FEEC/UNICAMP – Av. Albert Einstein, 400 13.083-852 — Campinas — SP - BRASIL
	Tel/Fax	(+55) 37 3229 1171	Tel/Fax	(55) 19 35213759
	Email	valter@ieee.org	Email	peres@dt.fee.unicamp.br
	France A		**France B**	
	Institution	LAAS-CNRS	Institution	L2S
	Project coordinator	Dr. Sophie Tarbouriech	Project coordinator	Dr. Giorgio Valmorbida
	Address	7 avenue du Colonel Roche, BP 54200, 31031 Toulouse cedex 4, France	Address	3 rue Joliot Curie, 91192 Gif-sur-Yvette, France

	Tel/Fax	(+33 (0)5) 6133 69 28 /61 33 69 69	Tel/Fax	+33 1 69851974/+33 1 69851389
	Email	tarbour@laas.fr	Email	giorgio.valmorbida@l2s.centralesupelec.fr

A7	**Other participating institutions**	
	In South America	**In France** **France C** GIPSA-lab UMR 5216 CNRS - Grenoble INP - Université Grenoble Alpes 11 rue des Mathématiques Grenoble Campus BP46 F - 38402 SAINT MARTIN D'HERES Cedex France Participants from GIPSA-lab : Dr. Christophe Pieur (christophe.prieur@gipsa-lab.fr) - Project coordinateur of France C Dr. Mirko Fiacchini (mirko.fiacchini@gipsa-lab.grenoble-inp.fr)

A8	**List of expected participants (name and affiliation and status : junior, senior)**
	France Dr. Sophie Tarbouriech – LAAS-CNRS, France (senior) Dr. Isabelle Queinnec – LAAS-CNRS, France (senior) Dr. Alexandre Seuret – LAAS-CNRS, France (junior) Dr. Luca Zaccarian – LAAS-CNRS, France (senior) Ass. Prof. Giorgio Valmorbida – L2S, France (junior) Dr Christophe Prieur – GIPSA-lab, France (senior) Dr Mirko Fiacchini – GIPSA-lab, France (junior) **Brazil** Prof. João Manoel Gomes da Silva Jr – UFRGS, Brazil (senior) Ass. Prof. Jeferson Vieira Flores – UFRGS, Brazil (junior) Ass. Prof. Diego Eckhard – UFRGS, Brazil (junior) Prof. Valter Júnior de Souza Leite – CEFET-MG (senior) Prof. Pedro Luis Dias Peres – UNICAMP, Brazil (senior) Ass. Prof. Ricardo R. L. C. Oliveira – UNICAMP, Brazil (junior) Ass. Prof. Matheus Souza – UNICAMP, Brazil (junior) **Chile** Prof. Daniel Sbarbaro Hofer – UC, Chile (senior) Ass. Prof. Alejandro J. Rojas – UC, Chile (junior)

A9	**International Project Coordinator (to be chosen among the Scientific Coordinators mentioned in A6)**
	Sophie Tarbouriech

B. Project Details

B1. Project guidelines

In this project, the main goal is to fill some gaps of the control theory in order to take into account the complex phenomena due to the presence of communication constraints, discontinuities, nonlinear elements, ... The focus is the development of new methods and tools to address the analysis (assessment of stability, performance, robustness, etc.) and the design of control laws are strategies for nonlinear dynamic systems, taking explicitly into account the operation over communications networks and the presence of hybrid behaviors. In particular, the nonlinearities to be considered can be classified in two sources: model nonlinearities (related to the dynamics of the system to be controlled) and sensor and actuator nonlinearities (with special emphasis on the saturation phenomenon). Concerning the communication constraints and their effect on the systems, special focus and attention should be paid to signal delays, asynchronous sampling, loss of information, distribution of the actuator and sensor.

B2. Project description

Goals, motivation, methodology and contribution of each participating institution

B2.1 Motivation

Nowadays, the majority of control systems are implemented over general purpose shared networks to take advantage of the effectiveness in terms of cost and flexibility the networks offer. In this configuration, the communication between sensors, controllers and actuators is performed on a network and occurs at discrete-time instants. This scenario describes what is commonly known as networked control systems (NCS). In other words, networked control systems (NCSs) are spatially distributed systems for which the communication between sensors, actuators, and controllers is supported by a shared communication network. In such applications, several distributed plants are controlled over a communication network and the controllers can be implemented in a decentralized way (i.e. in local processors). In this scenario, communication delays, packet losses and heavy temporary load of computation in a processor can lead to significant variations on the sampling time. These variations can dramatically affect the stability properties and the performance of the control system. In particular, classical techniques to model linear and time-invariant systems, as for instance the Z-transform and discrete-time models obtained from the assumption of constant sampling no longer apply to performance assessment or feedback control design. Furthermore, the digital coding of the signals sent through a network implies quantization effects that are related to the problem of controlling systems with limited information. These features can impact on the stability properties and the performance of the control system.

On the other hand, applications involving multi-agent systems and cooperative robotics rely on wireless communication, where each agent should communicate with his neighbors or with a leader (master) trough a radio link. In this case, the system is highly susceptible to signal delays and temporary loss of communications which can be catastrophic to the control of each dynamic agent and the behavior of the whole system. Moreover, in this kind of applications the energy storage and consumption are critical. Indeed, there are peaks of energy consumption for transmission/reception of data. Hence, to reduce the sampling activity, i.e. the time instants where the measurement information is transmitted is of great importance. This can be achieved for instance with the formal development of event-trigger control strategies, which can be considered as an aperiodic sampling policy.

The present project can therefore be placed at the intersection of the control systems and communications theories. From a control perspective, the main objective is the proposition of new analysis methods to assess stability and performance of control loops implemented over networks as well as new design techniques to cope with the particularities introduced by communication channels and networks. From a network point of view, the idea is to characterize how and when the behavior of the closed-loop system starts to degrade and how such information can be used to better parameterize the network.

B2.2 Project scope

This Project focuses on the problem of controlling dynamical systems taking into account communication constraints, which is part of the so-called networked control systems (NCSs) problem. In particular, we are interested in the effects of communication delays, packet losses and asynchronous sampling, induced by the communication channel or protocol in the behavior and the performance of the closed-loop system. It is well known that delays and loss of information can have disastrous impacts on the stability of dynamical systems and can significantly degrade the performance of the controlled system with serious economic and physical consequences. Another important issue, in digital control loops operating over communication networks is the signal quantization. This problem is related to what is called control under reduced information. Due to bandwidth constraints, it is interesting to code information with less bits in order to maximize the amount of transmitted data in a given slot of time. However, the quantization of the signals can be seen as a nonlinearity and may induce undesirable phenomena on the control loop, such as limit cycles, chaotic behavior, performance degradation and instability as well. Thus,

firstly, the present project aims to develop theoretical tools to assess stability and performance of control systems operating on communication networks. Secondly, it should be proposed methods for the design of control laws to ensure stability and a certain degree of performance, taking into account communication delays, packet losses, sampling and quantization.

B2.3 Objectives

The general objective of the present project is the development of formal analysis and design methods for dynamical systems operating over communication networks. In the analysis context, the methods should provide efficient computational tools to assess stability and performance of closed-loop systems in the presence of communication delays, aperiodic sampling, data packet losses and signals quantization. These tools must be able to quantify admissible delays, maximal inter-sampling intervals and quantization coarseness for which stability of closed-loop systems is preserved and performance degradation is kept under admissible levels. On the other hand, regarding the design, methods should take explicitly into account for, during the control law design, the communication delays, the number of bits for coding information, data losses and aperiodic sampling in order to satisfy stability and performance requirements.

More specifically, the following sub-problems should be treated:

1. Control subject to aperiodic sampling and delay of communication;
2. Event-based and event-triggered control;
3. Control subject to quantized information.

In these problems, we aim at considering both linear and nonlinear dynamical systems (plants) and also nonlinearities caused by sensors and actuators (such as saturations, dead-zones and hysteresis). We will mainly focus on lumped parameter systems, but distributed parameter systems, whose dynamics is described by partial differential equations should be also considered.

We detail next the specific objectives of analysis and design for each one of the sub-problems aforementioned.

Sampled-data systems

Control of sample-data systems has been widely studied in literature (see for instance (Chen and Francis, 1995), (Zhang and Branicky, 2001) and references therein), in particular when the sampling period is held constant (case known as periodic sampling). On the other hand, motivated by the development of networked controllers, special attention has been paid to the case of aperiodic sampling, i.e. when the time between two sampling instants is not necessarily constant and may vary significantly with packet losses or with the chosen communication protocol. In this context, (Suh, 2008) and (Oishi and Fujioka, 2009) considered an uncertain system approach to deal with the effects of period variation, nevertheless it was not possible to consider nonlinearities in the plant. Continuous-time strategies such as the ones in (Fridman et al., 2004), (Fridman, 2010), (Seuret, 2009) are based on Lyapunov-Krasovskii functionals and assume a time-varying input-delay model for the aperiodic sampling. In these approaches, it is possible to consider uncertainties and nonlinearities in the plant, at the cost of formulating more conservative conditions than the ones obtained through discrete-time approaches. Hence, an open research problem is the development of less conservative conditions based on these functionals. Recently, (Seuret, 2012) proposed a method that combines the benefits of both continuous and discrete-time formulations, where the discrete-time Lyapunov stability theory is used to analyze the evolution of continuous-time states through the use of looped-functionals. In particular, this technique has presented promising results in the analysis of systems with rational or Lur'e type nonlinearities, linear varying parameters and/or saturated inputs. Finally, some references considered the sample-data system as a type of hybrid/jump system and aimed to design state-feedback controllers. However, in a practical perspective it is important to consider the case where a dynamic controller is implemented in discrete-time (digital) as presented in (Gomes da Silva et al. 2016). This reference considered only the stability analysis, whilst the dynamic controller design remains a problem to be investigated.

Event-based and event-triggered control

Self-triggering strategies have been proposed to deal with issues such as limited communication capabilities, energy consumption and computational constraints. In many applications such as wireless sensor nodes, energy consumption can be a critical issue since these devices are in general fed by batteries. Indeed, there are peaks of energy consumption related to transmission/reception of data. Hence, it is of great importance to reduce the sampling activity, i.e. the instants where the measurement information is transmitted. Most results in this area considered the synthesis of state-feedback or dynamical controllers (mostly PIDs) under heuristic sampling strategies and without formal stability guarantees (Bjorkbom and Johansson, 2010), (Durand and Marchand, 2009). As usual in controllers based on state-feedback approaches, it is assumed that all system states are measured and available for feedback at each time instant, assumption that may not be found to be valid in most real-life applications. Hence, it is of major importance the development of control structures and triggering conditions based only on the output signals, i.e. the data effectively measured by sensors. Other relevant research problem in event-triggered control lies in the fact that most techniques consider that the controller dynamics evolves in continuous

time and that only the sensor measurement is sampled (Donkers et al., 2011), (Lehmann and Johansson, 2012). A more realistic case where the controller is also sampled (digital) and implemented in a different network node still needs to be properly explored in the literature. A possible solution in this context is to employ state observers as proposed in (Tarbouriech et al. 2016). Other important aspect, at least in the case of linear systems, is to consider the stability problem in the discrete-time context, assuming that sensor measurements are available at a high sample rate, however data transmission and control signal update is performed aperiodically and governed by a triggering function. The extension of these techniques to nonlinear systems poses itself as a challenging research topic to be investigated. Finally, following the same ideas as presented for sampled-data systems, event-trigger control can be modeled as a hybrid/jump system, where the occurrence of specific jump systems phenomena such as Zeno solutions must be taken into account. When dealing with linear systems, the absence of Zeno solution can be ensured by the jointly application of continuous and discrete-time linear system theories. For nonlinear systems, a possible solution to be investigated may lie in the hybrid systems framework proposed in (Van der Schaft and Schumacher, 2000) and (Goebel et al., 2012).

Control subject to quantized information

Another phenomenon that frequently occurs in networked control systems is signal quantization. Since the network information is transmitted digitally, both sensor measurements and the control signal must be coded with a fixed number of bits. Hence, by considering a sparser quantization (with less bits) it is possible to reduce the amount of data transmitted and consequently to avoid/mitigate problems caused by high network traffic. On the other hand, from the control system point of view, quantization can be seen as a system nonlinearity and may induce nonlinear behaviors such as limit-cycles, chaotic orbits and instability (Ceragioli et al., 2010), (Kalman, 1956), (Gray and Neuhoff, 1998), (Elia and Mitter, 2001). Hence, depending on the quantization type (uniform, logarithmic) and the number of quantization levels, different stability problems can be generated in the control loop even for linear systems. In particular, it may not be possible to ensure stability in a global context or to guarantee the convergence of system trajectories to the desired equilibrium point. Motivated by these problems, several references can be found in the literature (see (Brockett and Liberzon, 2000), (Fu and Xie, 2005), (Coutinho et al. 2010), (Maestrelli et al., 2012), (Tarbouriech and Gouaisbaut, 2012), (Ferrante et al., 2015) and references), nevertheless most of these works considered only continuous or discrete-time linear systems, state-feedback controllers and static quantizers. In addition, the problem of both quantization and control saturation has not been properly explored in the literature. In this project, we aim to develop conditions to address the problems of stability and control design under quantization for nonlinear systems with both periodic and aperiodic sampling, as well as the problem of quantized event-trigger control.

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B2.5 Methodology

The methodology to be followed can be split in three topics: modeling, analysis and design conditions, numerical computations and optimization.

Modeling

The first step to address the proposed problems rely on modeling the system in study and the phenomena induced by the communication channel or network.

Concerning the dynamic systems, both linear and nonlinear models will be considered. In order to allow efficient numerical treatment, the classes on nonlinear systems considered will be the following: Lur'e Systems (Castelan et al 2008), rational systems (which encompasses bilinear, quadratic and polynomial ones (Coutinho et a. 2008) (Nemcova et al. 2009)) and quasi LPV (linear parameter varying) representations (Amato 2006). These classes allow to model a large amount of physical process and systems. Moreover, they allow to formulate conditions for assessing stability or control design in the form of linear matrix inequalities (LMIs) or quasi-LMIs that can be incorporated in optimization problems and numerically efficiently solved (El Ghaoui et al. 1996). Another important issue is the modeling of nonlinearities in sensors and actuators, such as saturation, dead-zones and backlash. The modeling of distributed systems through partial differential equations should also be considered.

Delays induced by the communication are in general uncertain and varying. In this case, a state space approach to model the dynamic systems and the corresponding varying delays on control and measured signals will be adopted. Differently from frequency domain approaches, which applies only to linear and time-invariant dynamics, the state space approach allows to treat linear as well as nonlinear systems, time invariant or not. Packet losses can also be model through the use of varying delays. On the other hand, the modeling of sampling can basically follow 3 approaches: using a hybrid systems framework and considering the so-called impulsive systems; the time delay approach, which consists in modeling the sampling phenomenon as an increasing varying time delay that resets at each sampling instant; or considering the variation of the sampling interval as an uncertainty with respect to a periodic nominal sampling.

Quantization can be modeled by a nonlinearity on the actuator or sensor. For static quantization, it will be considered uniform and logarithm quantizers. In this case, the nonlinear function can be modeled by a sector bounded condition. Moreover, physical quantizers naturally presents a dead-zone and saturation limit (overflow). On the other hand, more complex quantization scheme could be addressed as hybrid dynamical quantizer in order to reduce the chattering and discontinuous effect around the desired equilibrium points. Such phenomena are undesirable since fast switchings lead to a large number of transmissions per unit of time, which can be problematic.

Formulation of Analysis and Design Conditions

From a correct modeling of the system and the communication constraints, the analysis and design conditions will be carried out in a Lyapunov theory framework. Considering delays, a Lyapunov-Krasovskii approach and the recent Looped-functional approach will be considered. The Lyapunov approach also applies to hybrid systems formulations and nonlinear systems. It does indeed appear that nonlinear and hybrid techniques will be useful in the context of the project, due to the impulsive nature of some of the phenomena under consideration, where some variables may require experiencing instantaneous jumping due to several reasons that include representing sampling phenomena (causing a discontinuity of the sample at the sampling instant), representing quantization (so that the quantized information can be seen as a jump of the corresponding state, whenever the input of the quantizer reaches a certain threshold) and similar sampled-data phenomena. A powerful and effective framework to represent these hybrid behaviors and thereby exploit suitable Lyapunov tools for assessing the stability properties of the arising controlled systems, is the one recently proposed in the manuscript (Goebel et al. 2012), where most of the classical results on Lyapunov stability have been extended from the historical context of purely continuous-time or purely discrete-time systems, to hybrid systems comprising solutions that may flow or jump, thereby well representing the sampled-data contexts addressed in this project.

In addition to the use of classical quadratic Lyapunov candidate functions and functionals, more generic ones should be exploited as: polynomial and rational functions, Lure type functions and parameter dependent functions.

The Lyapunov framework allows to derive conditions for both guaranteeing stability and a certain level of performance for the closed-loop system. Moreover, model uncertainties can also be considered. Hence, based on this framework conditions for the following classes of problems will be derived.

Analysis: Given a control system (linear or non-linear), the objective is to evaluate the behavior of the system in terms of stability, robustness and performance, taking into account that the system is subject to aperiodic (asynchronous) sampling, quantized inputs and outputs as well as nonlinearities in sensors and actuators (saturation, for example). In this sense, it is important, for example, to estimate the region of attraction of the equilibrium point of interest (Chesi 2011), maximum tolerable communication delays, performance degradation imposed by network constraints and actuators / sensors, minimum number of bits for encoding, etc.

Design: In this case, the objective is to propose new methods of designing control laws to take into account the effects of aperiodic samplings, quantization and non-linearity (model and sensor and actuator). In addition to linear state feedback type control laws, special attention should be given to the study of possibly non-linear control laws and dynamic output feedback of linear systems subject to saturation, quantization and other nonlinearities. Such methods should propose effective solutions for the computation of the controller parameters to, for example, maximize the region of attraction or maximize the maximum variation of the sampling period for which stability or a certain degree of performance is preserved.

Numerical Computations and Optimization

The obtained conditions for analysis and design will be formulated in terms of verification of linear matrix inequalities (LMIs). Once formulated in this way and with an appropriate parameterization, the parameters of the Lyapunov function appear as free variables, which provides flexibility in analysis problems. On the other hand, depending on the considered system model, and suitable parameterization, the control law parameters (static or dynamic) also appear as decision variables. Thus, LMIs can be incorporated as constraints in optimization problems and numerically efficiently solved. It should be pointed out that LMIs are convex constraints. In particular, the following optimization problems are of interest: compute maximum allowable delays and sampling intervals to ensure the stable behavior, compute minimal number of bits to guarantee stability and a certain performance, estimate regions of attraction (for nonlinear systems), or even, compute the controller parameters in order to maximize the admissible delays, reduce control updating (in event-trigger strategies, for instance), maximize the region of attraction, among other optimization criteria.

B2.6 Expected results

The expected results can be summarized as follows:

- Improve the understanding of the effect of different network features on the behavior of control systems operating on communication networks.
- Development of new techniques and methods for control design and analysis for systems presenting nonlinearities operating in communication networks.

- Based on the techniques and methodologies proposed, development of computational tools for analysis and synthesis of non-linear NCS systems (namely toolboxes and routines for MATLAB).
- Development of a low-cost set-up for testing the proposed approaches. Test and evaluation of the techniques on industrial communication networks.
- Narrow the gap between control and network implementation practices.
- Joint publications of articles in international journals and conferences.
- Exchange of PhD and MSc students (with possibly thesis co-orientation) and Post-Docs.

B3. Schedule, with main execution stages

This project is two years long, then we can organize the main execution stages as follows.

1st Year

- Month 1 to 4: Share of technical information between each participant and bibliographical review.

- Month 5 to 12: Development of new theoretical techniques and methods allowing the analysis and design techniques for networked observers and control systems.

- Month 10 to 12: Generation of publications of the preliminary results and a technical report.

2nd Year

- Month 1 to 6: Development of new theoretical techniques and methods allowing the analysis and design techniques for networked observers and control systems and development of computational algorithms and software packages (as Matlab toolboxes).

- Month 7 to12: Validation of algorithms in simulation.

- Month 8 to 12: Discussion on possible validation in experiments. Generation of journal publications and final technical report.

- Month 11 to 12: Organization of a workshop to present the main results and the open challenges.

Organization of seminars and workshops

As most of the project participants should attend the IFAC Symposium on Robust Control (ROCOND 2018) that will be held in Florianópolis, Brazil, in 2018, a project meeting day (before or after the Symposium) should be organized to gather all (or almost all) participants of the project to present current work and discuss new actions for the next year. It could be interesting also to organize an invited session in the next Conference on Decision and Control (CDC) or American Control Conference (ACC) allowing to present the results to the community.

During the mission of each researcher, a seminar and/or a lecture on the topic related to the project could be organized for attracting the master/PhD students of the hosting institution.

Finally, depending on the allowed funds, a two-day workshop in LAAS-CNRS including invitation of international speakers could be organized.

B4. Contributions

Present contributions so as to highlight the role of each partner and the integration among partners.

Contribution of each participating institution

It follows the domains of expertise of each one of the partners

- UFRGS: analysis and design of control laws taking into account nonlinear behaviors and time-delays; state estimation; event-trigger control; sample-data control; experimental assessments of NCSs.
- CEFET-MG: analysis and design of control laws for uncertain systems with time-delay and nonlinearities; hybrid control of uncertain systems; experimental tests in laboratory.
- UNICAMP: control and filtering for uncertain systems, switched systems, networked control systems, robust stability analysis, robust control design for Markov jump linear systems, sampled-data systems.
- LAAS-CNRS: developments of control laws taking into account delays; hybrid, switching and reset

behaviors; developments of control laws taking into account isolated nonlinearities; reset control loops; analysis and synthesis of control systems in presence of space-quantization.

- L2S: control synthesis for PDE systems; development and release of new version of the INTSOSTOOLS plugin to the toolbox SOSTOOLS, containing a set of functions that apply for the analysis of event-triggered control; analysis of Lure systems in particular with quantization on the control and the measurements.
- GIPSA-LAB: developments of control laws in presence of time-quantization; hybrid dynamical systems; analysis and synthesis of control for systems described by partial differential equations.
- Universidad de Conceptión: nonlinear control; adaptive control strategies; MPC strategies; control over wireless networks, state estimation; applications to process control

B5. Regional Aspects

Indicate how the activities will stimulate effective scientific interactions between all the participants.

Most of the participants have already being collaborating for several years but to maintain at a high level such kinds of collaborations, financial support is major. Indeed, funds allow to meet, to materialize the common objectives and to have strong relationships. Furthermore, this kind of project allows during the visits of the members to create new links in the hosting institutions. These links will be also reinforced by long term visits by PhD students, though sandwich stays and thesis co-supervision, and post-docs.

On the other hand, the development of work on a common research subject will also foster a more effective national cooperation between members of different teams of the same country. In particular, the project will naturally lead to the participation of these members in thesis evaluation committees and national meetings, leading to new discussions and partnership enhancement.

B6. Institutions and CVs of coordinators

Description of each participating institution, and curriculum vitae of each participant (maximum 2 pages per participant).

Brazil:

- Universidade Federal do Rio Grande do Sul (UFRGS): the activities will be developed in the Group of Automation, Control and Robotics (GCAR). The GCAR is a CNPq research group and it is attached to the Program of Post-Graduation in Electrical Engineering of the UFRGS. The researchers directly involved are: Prof. J.M. Gomes da Silva Jr., Prof. Jeferson Vieira Flores and Prof. Diego Eckhard. 4 PhD students are being supervised on subjects directly related to the present project (sampled-data systems, event-trigger control). One of them is currently in France for a sandwich PhD at LAAS-CNRS, co-supervised by Dr. S. Tarbouriech.
- Centro Federal de Educação Tecnológica de Minas Gerais (CEFET-MG): the activities will be developed in the Laboratory of Signals and Systems with the Group of Modeling and Control of Mechatronics Systems (MCSM), which is a CNPq research group attached to the Programa of Post-Graduation in Electrical Engineering of the CEFET-MG and Universidade Federal de São João del-Rei (UFSJ). The researcher directly involved is Prof. Valter J. S. Leite and his students.
- Universidade Estadual de Campinas (UNICAMP): The activities will be conducted in the School of Electrical and Computer Engineering at Unicamp (FEEC/UNICAMP). FEEC has a solid reputation in both undergraduate and graduate courses, being responsible by the Graduate Program in Electrical Engineering of Unicamp, one of the leading programs in Brazil, evaluated with the highest degree by CAPES. The research team is composed by Prof. Pedro L. D. Peres, Prof. Ricardo C. L. F. Oliveira, Prof. Matheus Souza and their students (around 10 Ms, 5 PhD and 2 Post-doc).

Chile:

- Universidad de Concepción (UC): The Department of Electrical Engineering is one of the leading departments on Electrical Engineering in Chile, having a strong accredited Ph.D. program. The researchers associated to this project are Prof. Daniel Sbarbaro and Prof. Alejandro Rojas. At least one Phd student working on control/estimation over wireless networks will be involved in the project.

France:

- LAAS-CNRS: the activities will be developed in the group MAC (Methods and Algorithms for Control). The

researchers directly involved are: Dr. Isabelle Queinnec, Dr. Alexandre Seuret, Dr. Sophie Tarbouriech and Dr. Luca Zaccarian. A Phd Student should join the team in September to work about reset control systems and therefore could be involved in this project.

- GIPSA-LAB: the activities will be developed in Gipsa-lab. The researchers directly involved are: Dr. Mirko Fiacchini and Dr. Christophe Prieur. A Phd Student is foreseen to work on switched systems and stability theory and therefore could be involved in this project.
- L2S: The project research will be carried out in the L2S - Laboratoire de Signaux et Systèmes. More precisely by Associate Prof. Giorgio Valmorbida, member of the Pole Automatique et Systèmes and of the Automatic Control Department of CentraleSupelec. There is a perspective for the recruitment of an PhD student for the period 2017-2020 who will get involved in the project. There is the perspective of a joint supervision of the student with the participants of LAAS and the UFRGS.

The CVs of all the permanent staffs involved in the project are appended in the end of this proposal.

B7. Additional information

List all the complementary fundings expected or already obtained.

From the French part, one can focus in particular on the following funding projects (which have some links with the topic of the current STIC-AmSud Project):

- SEFA IKKY project in collaboration with AIRBUS and ONERA (2017-2019), Leader: S. Tarbouriech (regarding the use of hybrid loops to help solving bugs in pilot control law.
- SCIDIS ANR JCJC (2016-2020), Leader: A. Seuret (regarding Stability and Control of Infinite Dimensional Systems).
- GDRI SPaDisCo (2017-2020), Leader: G. Valmorbida (regarding distributed parameters subject to constraints).

From the Brazilian side, we can mention:

- CNPq (Universal Call 2016). Leader: J.M. Gomes da Silva Jr. Subject: Development of Techniques for Networked Control and UPS Systems)
- Both Professors J.M. Gomes da Silva Jr. and Pedro Peres are CNPq level I researchers and receive a grant (CNPq-PQ grant) that can be used for instance to complement the funding for visits or other expenses related to the project.
- FAPESP (Regular Research Grant 2017-2019). Leader: Matheus Souza. Subject: A contribution to Sampled-Data and Switched Systems Control.

From Chile we can cite:

- As an associated researcher of the Solar Energy Research Center (Fondap No. Nº15110019), D. Sbarbaro can use funds for complementing the funding for visits or other expenses related to the activities of the SticAmsud Project.
- Alejandro Rojas can also use some funds from his Fondecyt Project 1150116 to finance some local expenses concerning the visits of international researchers.

Experience of the coordinators in similar projects.

Sophie Tarbouriech has already managed several international or national projects, like CNRS-CNPq projects with Brazil (bilateral projects 1995-1997, 1998-2001, PICS 2000-2003), FAPESP-CNRS with Brazil (2006-2008), CAPES-COFECUB (2008-2011 + 2013-2014), STIC-AmSud (France, Chile, Brazil - 2008-2009, 2013-2014), CNRS-NSF project with USA (bilateral project 1999-2001, PICS 2002-2005), CNRS-Oxford (2013), French research project funded by ANR (Limicos 2013-2016) or French industrial projects with CNES and EADS (PIROLA 2000-2003), SNECMA and ONERA (2005, 2006), AIRBUS and ONERA (2008-2012, 2017-2019) during the last 10 years. Participation to European project NICE (2009-2012) or European networks HYCON (2004-2008), HYCON2 (2011-2014). In this context, she has co-organized several workshops related to international or national projects of cooperation (see, for example the link of Workshop CO4 in October 2016 related to systems with limited information (https://sites.google.com/site/co4workshop/)). She has co-edited 1 special issue in IJRNC, 5 books and written a monograph published in 2011 with G. Garcia, J.M. Gomes da Silva Jr. and I. Queinnec (S. Tarbouriech, G. Garcia, J.M. Gomes da Silva Jr., I. Queinnec. “Stability and Stabilization of Linear Systems with Saturating Actuators”, Springer-Verlag, 2011).

João Manoel Gomes da Silva Jr. has already participated to many international cooperation projects with France such as CNPQ-CNRS PICs ref. 910081/99-9 (1999-2002), CAPES-COFECUB ref. 590/08 (2008-2011). He was local coordinator of a CAPES-STICAmSud project (2007-2009) and Brazilian coordinator of a CAPES-STICAmSud (2013-2014). He participated also in a CAPES-MECD ref. 004/01 (2002-2005) cooperation project between Brazil and Spain. Moreover, he was coordinator of the student international mobility commission of the UFRGS School of Engineering, managing, in particular, several bilateral CAPES-BRAFITEC projects for student exchanging between Brazil and France. Between October 2013 and July 2014 he was general coordinator at CNPQ of the Science without Borders Program of the Brazilian Government. He is currently CNPq level 1 researcher and has been acting as ad hoc consultant for proposals of international projects submitted to CAPES and CNPq, Brazil and also for ANR-France

Daniel Sbarbaro has participated in two Ecos Projects C01E07 and C12E08 during (2006-2008) and (2013-2015) respectively, two STIC-AmSud projects (France, Chile, Brazil - 2008-2009) and (France, Chile, Brazil - 2013-2014), and a CNRS-Conicyt (2009-2010). These projects have been fundamental for the development of the post-graduate program at the Universidad de Concepcion Electrical Department enabling the co-supervision of Master and Ph.D thesis and the exchange of faculty and students.

Present main activities and their relationship with the project's main goal.

The present main research activities of **Sophie Tarbouriech** are related to the study of nonlinear and hybrid systems in both theoretical and practical points of view. She works also on systems subject to isolated nonlinearities (as saturation, backlash), on systems subject to limited information (as quantization, sporadic measure). In these contexts, she has coordinated a special issue in an international journal (C. Prieur, S. Tarbouriech. Special Issue: New Directions on Hybrid Control Systems, International Journal of Robust and Nonlinear Control, vol.21, issue 10, pp.1063-1236, 2011) and some collective books (J. Daafouz, S. Tarbouriech, M. Sigalotti. Hybrid Systems with Constraints, Wiley, 2013; S. Tarbouriech, A. Girard, L. Hetel. Control subject to Computational and Communication Constraints: Current Challenges, Springer, to appear).

The present main research activities of **João Manoel Gomes da Silva Jr**. regard the study of new methods for the analysis and synthesis of nonlinear control systems, time-delay systems and systems presenting constrained actuators. In this context, he has published several articles in international journals and, in particular a book co-authored with S. Tarbouriech and I. Queinnec, ("Stability and Stabilization of Linear Systems with Saturating Actuators", Springer-Verlag, 2011) as well as the chapter about time-delay systems of the Brazilian Encyclopedia of Automation. This last one co-authored with Valter Júnior de Souza Leite. Recently he started studies regarding sample-data systems, with focus on aperiodic sampling and nonlinear systems, and event-trigger control both for linear and nonlinear systems.

The current research interest of **Daniel Sbarbaro** in the area of sensor networks spans two areas. The first one deals with the design of nonlinear observers for distributed parameter systems by using wireless sensor networks, and the second one deals with the control of Single Input Multiple Output systems, where the outputs are sensed by a network of sensors. The main applications of these developments are those one where the main variables are spatially distributed, such as real time monitoring of contaminants using distributed measuring stations or the control of a very large infrastructure systems such as flexible structures and solar concentrator fields.

Perspectives of continuing collaboration after project financing is over.

The Brazilian groups (UFRGS, UNICAMP, CEFET-MG) have kept a strong collaboration with the French groups. In particular, the three Brazilan institution coordinators Prof. Pedro Peres, Prof. Gomes da Silva and Prof. Leite did their PhD in the LAAS. For almost 20 years a strong and fruitful collaboration between their groups of research and the LAAS group has been developed. This collaboration was supported by one COFECUB and two STICAmSud projects, which where fundamental to straight and enforce the collaboration. On the other hand, even during the years without financial support the collaboration has been kept through the exchange of PhD students (4 sent by P. Peres and 3 by J.M. Gomes da Silva Jr) for sandwich periods and co-supervision and short term visits. The result of this collaboration can be attested by innumerous joint publications. It should be also mentioned that Prof. Vamórbida, now in L2S, spent few weeks in UNICAMP and UFRGS when he was doing his PhD at LAAS.

In 2010 Prof. Gomes da Silva spent one month, as invited professor (funded by Erasmus Project), in the GIPSA-Lab and in 2016 he spent two weeks funded by a project from Dr. C. Prieur and Dr. M. Fiacchini. The collaboration between Dr. Prieur and Prof. Gomes da Silva dates basically from 2005, as attested by several joint publications. Recently, 2015-2016, Prof. V. Leite sent a PhD student to work with Dr. C. Prieur.

Successful collaborations between the Brazilian, the French groups and the Chilean groups have started in 2007 in the context of a previous STICAmSud project. Since then, many joint works have been developed. In particular, during his PhD, Prof. J. Flores stayed one month with Prof. Sbarbaro in Concepcion. Prof. Sbarbaro has also sent students to UNICAMP in the context of a previous STICAmSud project.

The present project will reinforce and strength these collaboration links, now through the inclusion of young and bright researchers, namely Prof. J. Flores, D. Eckhard, R. Oliveria, M. Souza, A. Seuret, M. Fiacchini, A. Rojas and G. Valmorbida.

Hence, from the partnership history, the perspectives of continuing the collaboration and the search for new sources of financing after this project are then very high.

B8. International referees

Suggest names of at least 3 international referees to evaluate the project. These researchers should not be connected to people in the project.

1- Daniel Liberzon (USA)

2- Alessandro Astolfi (Italy)

3- Claudio De Persis (The Netherlands)

Names of referees who should not review this project in your opinion (optional)

1-

2-

B9. Public and private support obtained related to the project:

Previous project STIC AMSUD / MATH AMSUD?
YES (STIC AMSUD)

If YES, indicate the code, the year and the name of the project:

- 07STIC-07- STIC AMSUD (2008-2009): Analysis and Control of Dynamic Systems presenting Nonlinear Behaviors, Uncertainties and Time-Delays
- 038/2013 - STIC AMSUD (2012-2013): ADNEC-Analysis and Design Methods for Networked and Embedded Control Systems

Other public support in the past (ECOS, COFECUB, CNRS, European Union, etc.):

- Ma590/08 - CAPES-COFECUB (2008-2012): Analysis and design methods for dynamical systems subject to nonlinearities and delays.

Other private support in the past:
NO

Prospects for public or private support in the future:

The current research area is a hot subject and should attract interest for other collaborative projects, at the academic level and in industrial context.

C. Project Budget

Project title: Control of Dynamical Systems under Communication Constraints (CoDySCo2)

Participating institutions: CNRS, CAPES, CONICYT

The STIC-AmSud program **funds travel expenses** (air tickets and *per diem*) to researchers in research missions and workshops.

C1. First year (2018)

Planned missions – Year 1

Researcher	Status (student, junior, senior)	Institution	Origin	Destination	Planned date	Duration (max. 30 days)	Estimated cost of the trip (€)	Estimate of total *per diem* (€)	Trip and Mission funding institution[1]	Mission objectives
S. Tarbouriech	Senior	CNRS	Toulouse	Porto-Alegre et Campinas	Spring	15	1.300	1.800	CNRS	Research, lecture and seminars
I. Queinnec	Senior	CNRS	Toulouse	Porto-Alegre et Campinas	Spring	15	1.300	1.800	CNRS	Research, lecture and seminars
C. Prieur	Senior	CNRS	Grenoble	Porto-Alegre et Conception	Spring	11	1.700	1.320	CNRS	Research and seminars
João M. Gomes da Silva Jr.	Senior	UFRGS	Porto Alegre	Concepcion	August	7	560	1.238	CAPES	Research and Seminars
Jeferson V. Flores	Junior	UFRGS	Porto Alegre	Concepcion	August	7	560	1.238	CAPES	Research and Seminars
Valter J. S. Leite	Senior	CEFET-MG	Belo Horizonte	Grenoble		7	1.120	1.238	CAPES	Research and Seminars

[1] **Each institution will pay for the trip and per diem of its own researchers.**

Pedro Peres	Senior	UNICAMP	São Paulo	Toulouse		7	1.120	1.238	CAPES	Research and Seminars
Daniel Sbarbaro	Senior	UC	Concepción	Porto-alegre		15	800	750	CONICYT	Research and Seminars
Alejandro Rojas	Junior	UC	Concepción	Toulouse		15	1.500	1.500	CONICYT	Research and Seminars
Student 1	Junior	UC	Concepción	Porto-alegre		30	800	750	CONICYT	Research and Seminars
Student 2	Junior	UC	Concepción	Toulouse		30	1.500	1.500	CONICYT	Research and Seminars

CONSOLIDATED BUDGET: Year 1

Funding requested to the STIC-AmSud Program
Estimated costs (€)

	A. Travel costs (air tickets)	B- Maintenance costs (*per diem)*	**TOTAL**
MAEDI France			
CNRS France	4.300	4.920	9.220
INRIA France			
Institut Mines-Télecom France			
MINCYT Argentina			
CAPES Brazil	3.360	4.952	8.312
CONICYT Chile	4.600	4.500	9.100
CONACYT Paraguay			
CONCYTEC Peru			
ANII Uruguay			
MPPEUCT Venezuela			
SENESCYT Ecuador			
COLCIENCIAS Colombia			
Total requested funding to STIC-AmSud			
Other funding[2]			
TOTAL	12.260	14.372	26.632

Do you have additional funding sources for this project[3]? (if so please specify the amount and source (s)).

In the Brazilian side, a postdoctoral fellow position and a PhD sandwich position will be granted during the period of the project.

2 Specify in additional page.

3 Reserved for CNRS researchers

C2. Second year (2019)

Second year funding depends on approval of intermediate progress report.

Planned missions – Year 2

Researcher	Status (student, junior, senior)	Institution	Origin	Destination	Planned date	Duration (max. 30 days)	Estimated cost of the trip (€)	Estimate of total *per diem* (€)	Trip and Mission funding institution[4]	Mission objectives
G. Valmorbida	Junior	CentraleSupelec	Paris	Campinas et Divinopolis	Summer	15	1000	1800	CNRS	Research and seminars
M. Fiacchini	Junior	CNRS	Grenoble	Porto Alegre	Spring	10	1200	1200	CNRS	Research and seminars
A. Seuret	Junior	CNRS	Toulouse	Porto Alegre	Spring	10	1200	1200	CNRS	Research and seminars
PhD student to be determined	Junior	CNRS	Toulouse, Grenoble or Paris	Porto Alegre	Autumn	10	1200	1200	CNRS	Research and course
João M. Gomes da Silva Jr.	Senior	UFRGS	Porto Alegre	Paris	February	10	1.120	1.730	CAPES	Research and Seminars
Pedro Peres	Senior	UNICAMP	São Paulo	Concepcion	August	7	560	1.238	CAPES	Reserach and Seminars
Ricardo C.L.F Oliveira	Junior	UNICAMP	São Paulo	Toulouse	February	15	1.120	2.550	CAPES	Research and Seminars
Daniel Sbarbaro	Senior	UC	Concepción	Toulouse		15	800	750	CONICYT	Research and Seminars
Alejandro Rojas	Junior	UC	Concepción	Porto-alegre		15	1.500	1.500	CONICYT	Research and Seminars

4 **Each institution will pay for the trip and per diem of its own researchers.**

Student 1	Junior	UC	Concepción	Toulouse		30	800	750	CONICYT	Research and Seminars
Student 2	Junior	UC	Concepción	Porto-alegre		30	1.500	1.500	CONICYT	Research and Seminars

CONSOLIDATED BUDGET: Year 2

Funding requested to the STIC-AmSud Program
Estimated costs (€)

	A. Travel costs (air tickets)	B- Maintenance costs (*per diem)*	**TOTAL**
MAEDI France			
CNRS France	4.600	5.400	10.000
INRIA France			
Institut Mines-Télecom France			
MINCYT Argentina			
CAPES Brazil	2.800	5.518	8.318
CONICYT Chile	4.600	4.500	9.100
CONACYT Paraguay			
CONCYTEC Peru			
ANII Uruguay			
MPPEUCT Venezuela			
SENESCYT Ecuador			
COLCIENCIAS Colombia			
Total requested funding to STIC-AmSud			
Other funding[5]			
TOTAL	12.000	15.418	27.418

Do you have additional funding sources for this project[6]? (if so please specify the amount and source (s)).

5

6 Specify in additional page.
Reserved for CNRS researchers

C3. BUDGET TOTALS

	Year 1	**Year 2**	**Total**
Funding requested to MAEDI (France)			
Funding requested to INRIA (France)			
Funding requested to CNRS (France)	9.220	10.000	**19.220**
Funding requested to Institut Mines-Telecom (France)			
Funding requested to MINCYT (Argentina)			
Funding requested to CAPES (Brazil)	8.312	8.318	**16.630**
Funding requested to CONICYT (Chile)	9.100	9.100	**18.200**
Funding requested to CONACYT (Paraguay)			
Funding requested to CONCYTEC (Peru)			
Funding requested to ANII (Uruguay)			
Funding requested to SENESCYT (Ecuador)			
Funding requested to MPPEUCT (Venezuela)			
Funding requested to COLCIENCIAS (Colombia)			
Matching funds from the partners			
Other sources			
TOTAL	**26.632**	**27.418**	**54.050**

ANNEX

CV of Sophie Tarbouriech

1/ Personal data

Name: Sophie Tarbouriech
Birth date: September 22, 1964
Professional address (with telephone and e-mail): LAAS-CNRS, 7 avenue du Colonel Roche, BP54200, Toulouse cedex 04, France – Tel: +33 (0)5 61 33 69 28 – Email= tarbour@laas.fr
Current job title and size of the research group: Full time researcher (Directeur de Recherche CNRS) in the MAC group (16 permanent staff)

2/ Highest obtained degree (with indication of place and date)

Habilitation à Diriger des Recherches (HDR), Université Paul Sabatier, Toulouse, May 1998.

3/ Professional activity in the last 5 years

Research activities: Hybrid dynamical systems (reset systems, switched systems); Control theory and applications of systems with limited information.
Invited Researcher: University of Sevilla, Spain (2012); University of Oxford, UK (2013); UFRGS, Brazil (2013, 2014, 2015); University of Trento, Italy (2016, 2017); University of Groningen, The Netherlands (2013); University of Lulea, Sweden (2015)

4/ Other duties/ positions

Associate Editor: IEEE Transactions on Automatic Control (IEEE-TAC, 2015-), IEEE Transactions on Control Systems Technology (IEEE-TCST, 2010-), European Journal of Control (EJC, 2013-), Automatica (2015-). Board member of International Journal of Robust and Nonlinear Control (IJRNC, 2015-). Senior Editor for IEEE Control Systems Letters (2017-).
CEB (conference editorial board): IEEE (for American Control Conference (ACC), Conference on Decision and Control (CDC), European Control Conference (ECC)).
Technical Committee (TC): Member of numerous IPC of international conference (ACC, CDC, ...). Member of the TC on Nonlinear Systems and TC on Robust Control of IFAC (International Federation of Automatic Control)), Member of the TC on Hybrid Systems (IEEE).
Committee of selection: Associate professor position ENS3E INP, Grenoble (2012), University of Lille (2013). CR INRIA (2013, 2016), DR INRIA (2014). ERC PE7 Starting grants (2014, 2016).
Evaluation of projects. NWO, The Netherlands (2014), ANR projet international (2011), Research projects of the University of Grenoble (2013, 2014, 2015, 2016), Italian Research and University Evaluation Agency (2012, 2013), ERC PE7 Advanced Grants 2014.

5/ Awards, fellowships and external recognition

Recipient of a fellow ship grant from 2013 to 2015 at UFRGS (Porto Alegre) (Program PVE).

6/ Ongoing funded research projects with dates, titles, sources of funding

SEFA IKKY (October 2016-October 2019): Cockpit integration – Hybrid systems approach for bug detection in the control loop, funded DGA, in collaboration with AIRBUS and ONERA.

7/ Projects approved in the least 5 years

LimICoS project (2013-2016): Limited Information Control Systems, funded by ANR, in collaboration with LAGEP, GIPSA-lab, L2S. ADNEC project (2013-2014): Analysis and Design Methods for Networked and Embedded Control Systems, funded by STIC-AmSud, in collaboration with GIPSA-lab (France), UFRGS, CEFET (Brazil), University of Conception (Chile). CNRS-Oxford (2013): Advanced Strategies for Feedback Control, funded by both CNRS and Oxford. CNRS-Oxford (2014): Anti-Windup techniques for rate-limited actuators on synchrotrons, funded by both CNRS and Oxford.

HYCON2 (Network of excellence - 2011-2014) : Highly-complex and networked control systems, funded by European community.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

- C. Prieur, S. Tarbouriech, L. Zaccarian. Lyapunov-based hybrid loops for stability and performance of continuous-time control systems, Automatica, Vol.49, No2, pp.577-584, February 2013.
- S. Tarbouriech, I. Queinnec, C. Prieur. Stability analysis and stabilization of systems with input backlash, IEEE Transactions on Automatic Control, vol.59, no.2, pp.488-494, February 2014.
- F. Ferrante, F. Gouaisbaut, S. Tarbouriech. Stabilization of continuous-time linear systems subject to input quantization, Automatica, vol. 58, pp.167-172, 2015.
- F. Ferrante, F. Gouaisbaut, R. G. Sanfelice, and S. Tarbouriech. State estimation of linear systems in the presence of sporadic measurements. Automatica, 73:101 – 109, 2016.
- A. Seuret, C. Prieur, S. Tarbouriech, L. Zaccarian. LQ-based event-triggered controller co-design for saturated linear systems, Automatica, vol 74, pp.47-54, 2016.
- C. Prieur, S. Tarbouriech, J.-M. Gomes da Silva Jr. Wave Equation With Cone-Bounded Control Laws, IEEE Transactions on Automatic Control, Volume 61, Issue 11, pp.3452-3463, November 2016.
- G. Valmorbida, L. Zaccarian, S. Tarbouriech, I. Queinnec, and A. Papachristodoulou. Nonlinear static state feedback for saturated linear plants via a polynomial approach. IEEE Transactions on Automatic Control, 62(1):469–474, Jan 2017.

8.2 – Publications in cooperation with the project partners

- D. Sbarbaro, S. Tarbouriech, and J. M. Gomes da Silva Jr., “An event-triggered observer based control strategy for SISO systems,” in Proceedings of the 53rd IEEE Conference on Decision and Control (CDC), pp. 2789–2794, Dec 2014.
- L. G. Moreira, L. B. Groff, J. M. Gomes da Silva Jr., and S. Tarbouriech, “Event-triggered PI control for continuous plants with input saturation,” in Proceedings of the 2016 American Control Conference, pp. 4251–4256, Jul 2016.
- G.C. Campos, J.M. Gomes da Silva, S. Tarbouriech, and C.E. Pereira. Stability of discrete-time control systems with uniform and logarithmic quantizers. IFAC-PapersOnLine, 49(30):132 – 137, 2016. 4th {IFAC} Symposium on Telematics Applications {TA} 2016, Porto Alwegre, Brasil, 6—9 November 2016.
- J. M. Gomes da Silva, I. Queinnec, A. Seuret, and S. Tarbouriech. Regional stability analysis of discrete- time dynamic output feedback under aperiodic sampling and input saturation. IEEE Transactions on Automatic Control, 61(12):4176–4182, Dec 2016.
- S. Tarbouriech, A. Seuret, J. M. Gomes da Silva, and D. Sbarbaro. Observer-based event-triggered control co-design for linear systems. IET Control Theory Applications, 10(18):2466–2473, 2016.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Francesco Fichera (Co-supervised with C. Prieur (GIPSA-lab)), PhD on stability and performance of hybrid dynamical systems, (PhD defense in October 2013); Francesco Ferrante (Co-supervised with F. Gouaisbaut (LAAS-CNRS)), PhD on stability of dynamical system with limited information (PhD defense in October 2015); Laura Dal Col (Co-supervised with L. Zacaarian (LAAS-CNRS)), PhD on consensus problems for multi-agent systems with saturation (PhD defense in October 2016).

9.2 – Ongoing

Matteo Cocetti (co-supervised with E**.** Bertolazzi, co-tutelle between INSA, Toulouse and University of Trento), PhD on reset control systems subject to saturation; Luciano Moreira (supervised by J.M. Gomes da Silva Jr., UFRGS, Brazil), in visit for one year in LAAS to work with me on event-triggered control for nonlinear systems

CV of João Manoel Gomes da Silva Jr.

1. Personal data:

Name: *João Manoel Gomes da Silva Jr.*

Birth date: *07/10/1969*

Professional Address with telephone and email:

Universidade Federal do Rio Grande do Sul, Dept. of Automation and Energy Syst (DELAE).
Av. Osvaldo Aranha 103, 90035-190 Porto Alegre, RS, Brasil
Phone: +55 51 3308 3140 E-mail: jmgomes@ufrgs.br

Current job title and size of the research group:

Full Professor. Member of the Group of Control, Automation and Robotics (GCAR) – Research group registered in CNPq/Brazil, currently supervising of 4PhDs and 2MScs.

2. Higher degree obtained (with indication of place and date)

Doctorat – Université Paul Sabatier, Toulouse, France, 1997.

3.Professional activity – Last 5 years

- *UFRGS, Dept. of Automation and Energy Systems, Porto Alegre, Brasil - Professor.*
- *CNPq – General Coordinator of the Science without Borders Program (2013 to 2014)*

4.Other duties/positions- Last 5 years

- *UFRGS: Coordinator of the Post-Graduation Program in Electrical Engineering (2012 to 2013)*
- *UFRGS: Head of Department (2014-current)*
- *FAPERGS (Research Funding Agency for the Rio Grande do Sul State) – Coordinator of the Technical Committee on Engineering (2015-current)*

5. Awards, fellowships and external recognition.

- *Member of the Conference Editorial Board of the IEEE Control Systems Society (2001-2016)*
- *Member of the IFAC Technical Committee on Linear Systems (2008-current)*
- *Member of the Brazilian Society of Automation Council (2015-current)*
- *Associated Editor of the Journals: IEEE Control Systems Letters, IFAC Journal on Systems and Control, Journal Eureopèen des Systèmes Automatisés.*

6. Ongoing funded rersearch projects with dates (beginning, end) title, sources of funding.

- *CNPq – (PQ level 1) Analysis and Design of Controllers for Nonlinear Systems Operating over Communication Networks (March 2016 to February 2020)*
- *CNPq (Universal Call 2016). Development of Techniques for Networked Control and UPS Systems (approved – waiting funding liberation)*

7. Projects approved in the last 5 years.

- *CNPq (Universal Call 2012) – Control of Nonlinear Systems subject to Communication and Control Constraints (2012-2014)*
- *CAPES-STICAmSud – Analysis and Design Methods for Networked and Embedded Control Systems (2013-2014)*

8. **Publications** (see http://www.ece.ufrgs.br/~jmgomes for a complete list of publications)

8.1 – Highlight the most important publications related to the project theme

- *[1] **S. Tarbouriech, A. Seuret**, J.M. Gomes da Silva Jr., **D. Sbarbaro**. Observer-based event-triggered control codesign for linear systems. IET Control Theory & Applications. vol. 10, pp. 2466 – 2473, 2016.*
- *[2] J.M. Gomes da Silva Jr., **I. Queinnec, S. Tarbouriech, A. Seuret**. Regional Stability Analysis of Discrete-Time Dynamic Output Feedback Under Aperiodic Sampling and Input Saturation. IEEE Transactions on Automatic Control. vol. 61, no. 12, pp. 4176-4182, 2016.*
- *[3] A.H.K. Palmeira, J.M. Gomes da Silva Jr**., S. Tarbouriech**, I. Ghiggi. Sampled-data control*

under magnitude and rate saturating actuators. Int. J. of Robust and Nonlinear Control. DOI: 10.1002/rnc.3503, 2016.

- *[4] L. G. Moreira, L.B. Groff, J.M. Gomes da Silva Jr. Event-triggered state-feedback control for continuous-time plants subject to input saturation. Journal of Control, Automation and Electrical Systems (Springer), v.27, n. 5, pp. 473-484, 2016.*
- *[5] **A. Seuret,** J. M. Gomes da Silva Jr. Taking into account period variations and actuators saturation in sampled-data systems. Systems & Control Letters, v. 61, p. 1286-1293, 2012.*
- *[6] L.B. Groff, L.G. Moreira, J.M. Gomes da Silva Jr. Observer-based event-triggered control: a discrete-time approach. Proc. of the American Contr. Conf., p. 4245-4250., Boston, 2016.*
- *[7] I. Ghiggi, J.M. Gomes da Silva Jr. D.F. Coutinho, C.E de Souza. Stability analysis of nonlinear rational sampled-data control systems over communication networks. Proc, of the 14th European Control Conference (ECC'15), p. 422-427. Linz, 2015.*
- *[8] J.M. Gomes da Silva Jr., V.M. Moraes, J.V. Flores, A.H.K. Palmeira. Sampled-data LPV Control: a Looped Functional Approach. Proc. of the 1st IFAC Workshop on Linear Parameter Varying systems (LPV'2015), p. 19-24, Grenoble, 2015.*

8.2 – Publications in cooperation with the project partners

Besides publications [1],[2],[3],[5] above we can cite

- ***S. Tarbouriech**, G. Garcia, J. M. Gomes da Silva Jr., **I. Queinnec**. Stability and Stabilization of Linear Systems with Saturating Actuators. 1. ed. London: Springer-Verlag, 2011.*
- ***A. Seuret,** F. Gouaisbaut, **S. Tarbouriech**, J. M. Gomes da Silva Jr. Improved Stability Criteria for Sampled-Data Systems with Input Saturation. In: M. Maliso, P. Pepe, F. Mazenc, I. Karafyllis (Org.). Recent Results on Nonlin.. Delay Contr. Syst. 1ed.: Springer 2016.*
- ***C. Prieur, S. Tarbouriech**, J.M. Gomes da Silva Jr. Wave Equation with Cone-Bounded Control Laws. IEEE Transactions on Automatic Control, v. 61, n. 11, pp. 3452-3462, 2016.*
- ***J.V. Flores**, J.M Gomes da Silva Jr**, D. Sbarbaro**, M.C Turner, A.T. Salton. Antiwindup Design for Zero-Phase Repetitive Controllers. Journal of Dynamic Systems, Measurement, and Control, v. 137, p. 094503, 2015.*
- ***J.V. Flores**, J.M Gomes da Silva Jr, L.F. Pereira, **D. Sbarbaro**. Repetitive Control Design for MIMO Systems with Saturating Actuators. IEEE Transactions on Automatic Control (Print), v. 57, p. 192-198, 2012.*

  *J. M. Gomes da Silva Jr., **S. Tarbouriech,** G. Garcia, **D. Eckhard**. Finite L2 gain and internal stabilisation of linear systems subject to actuator and sensor saturations. IET Control Theory and Applications, v. 3, p. 799-812, 2009*
- ***S. Tarbouriech, C. Prieur**, J. M. Gomes da Silva Jr. Stability analysis and stabilization of systems presenting nested saturations. IEEE Transactions on Automatic Control, v.51, p.1364-1371. 2006.*
- ***S.Tarbouriech**, J.M.Gomes da Silva Jr. Synthesis of Controllers for Continuous-Time Delay Systems with Saturating Controls via LMIs. IEEE-Transactions on Automatic Control,vol.45, no. 1 , pp.105-111, jan. 2000.*

9. Theses oriented and post-doctoral fellows supervised.

9.1 Finished/defended in the last 5 years

- *Jeferson V. Flores. Design of controllers for tracking periodic signals with saturating actuators. PhD Thesis, UFRGS, 2012.*
- *Maurício Z. de Oliveira. Stability and stabilization of a class of nonlinear systems subject to saturation. PhD Thesis, UFRGS, 2012.*
- *Vitor M. Moraes. Sampled data control of LPV systems. Pos-doc, UFRGS, 2015.*
- *Ilca M. Ferrari Ghiggi. Networked control of Rational Systems. Pos-doc, UFRGS, 2016.*

9.2 – Ongoing

- *L. G. Moreira. Event-trigger control for nonlinear systems. PhD Thesis*
- *A. K. Palmeira. Sampled-data control of LPV systems. PhD Thesis*
- *M. Longhi. Sampled-data control of rational systems. PhD Thesis*
- *L. Groff. 2D nonlinear systems. PhD Thesis*

CV of Daniel Sbarbaro

1/ Personal data

Name: Daniel Sbarbaro
Birth date: 17.04.1960
Professional address (with telephone and e-mail): Departamento de Ingeniería Eléctrica, Facultad de Ingeniería, Universidad de Concepción, Concepción, Chile. Teléfono: +56412004247 dsbarbar@udec.cl
Current job title and size of the research group: Professor

2/ Highest obtained degree (with indication of place and date)

Ph.D. University of Glagow, Scotland, U.K. 1992

3/ Professional activity in the last 5 years

Academic at the University of Concepción, Chile.

4/ Other duties/ positions

Member of the accreditation board for postgraduate programs, National Accreditation Board (CNA), 2012 at present.

5/ Awards, fellowships and external recognition

Alexander von Humboldt Fellowship

IEEE Senior Member

Concepción City Council Award for Applied Science

6/ Ongoing funded research projects with dates, titles, sources of funding

2014- Fondap Solar Energy Research Center Nº15110019, Fault diagnosis of photovoltaic and thermal energy systems.

7/ Projects approved in the least 5 years

2013-2015 Fondecyt 1103682, Modelling and control of systems with multidimensional sensing.

2013-2014 Idea CA12i10371, Characterization of molten phases and high temperature reactions in the cooper pyrometallurgy.

2010-2012 Fondecyt, Nonlinear state estimation for tomography applications: monitoring a sedimentation process.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

Jaime A. Rohten; Jose R. Espinoza; Javier A. Muñoz; Daniel G. Sbarbaro; Marcelo A. Perez; Pedro E. Melín; Jose J. Silva; Eduardo E. Espinosa, Enhanced Predictive Control for a Wide Time-Variant Frequency Environment, IEEE Transactions on Industrial Electronics
Year: 2016, Volume: 63, Issue: 9

H. Ramirez, B. Maschke, D. Sbarbaro. “Modelling and control of multi-energy systems: An irreversible port-Hamiltonian approach”, European Journal of Control, Volume 19, Issue 6, December 2013, Pages 513-520.

F. Betancourt, F. Concha, D. Sbárbaro. “Simple mass balance controllers for continuous sedimentation”, Computers and Chemical Engineering. 54, 2013, 34-43. ISSN 0098-1354. FI 2.873.

Villarroel, F.; Espinoza, J.R.; Rojas, C.A.; Rodriguez, J.; Rivera, M.; Sbarbaro, D. Multiobjective Switching State Selector for Finite-States Model Predictive Control Based on Fuzzy Decision Making in a Matrix Converter. IEEE Transactions on Industrial Electronics, , vol.60, no.2, pp.589-599, Feb. 2013

Javier A. Munoz; José R. Espinoza; Carlos R. Baier; Luis A. Moran; Eduardo E. Espinosa; Pedro E. Melin; Daniel G. Sbarbaro, Design of a Discrete-Time Linear Control Strategy for a Multicell UPQC, IEEE Transactions on Industrial Electronics, Year: 2012, Volume: 59, Issue: 10

Gonzalo Carvajal; Miguel Figueroa; Daniel Sbarbaro; Waldo Valenzuela, Analysis and Compensation of the Effects of Analog VLSI Arithmetic on the LMS Algorithm, IEEE Transactions on Neural Networks, Year: 2011, Volume: 22, Issue: 7

8.2 – Publications in cooperation with the project partners

Sophie Tarbouriech , Alexandre Seuret, João Manoel Gomes da Silva Jr., Daniel Sbarbaro, “Observer-based event-triggered control co- design for linear systems “, IET Control Theory & Applications, Published on line. doi: 10.1049/iet-cta.2016.0167

M. Parada, D. Sbarbaro, R. A. Borges & P. L. D. Peres (2017) Robust PI and PID design for first- and second-order processes with zeros, time-delay and structured uncertainties, International Journal of Systems Science, 48:1, 95-106, DOI: 10.1080/00207721.2016.1160453

.J. V. Flores; J. M. Gomes da Silva,, Jr.; D. Sbarbaro; M. C. Turner; A. T. Salton, Antiwindup Design for Zero-Phase Repetitive Controllers, ASME J. Dyn. Sys., Meas., Control. 2015; 137(9):094503-094503-5

J.V. Flores, J.M. Gomes da Silva, L.F.A. Pereira, D.G. Sbarbaro. “Repetitive Control Design for MIMO Systems With Saturation Actuators”. IEEE Transactions Automatic Control. 57(1), 2012, 192-198

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

H. Ramirez, “Control of irreversible thermodynamic processes using port-Hamiltonian systems defined on pseudo Poisson and contact structures,”, 2009-2012

9.2 – Ongoing

F. Lotero, “Modelling and control of co-rotating twin-screw extrusion process”, 2013-2017 to be defended in June 2017.

S. Vergara. “Real-time estimation of low dimensionl features using electrical impedance tomography”, 2016-

CV of Alexandre Seuret

1/ Personal data

Name: Alexandre Seuret
Birth date: February 29, 1980
Professional address (with telephone and e-mail): LAAS-CNRS, 7 avenue du Colonel Roche, BP31031, Toulouse cedex 04, France – Tel: +33 (0)5 61 33 78 90 – Email= aseuret@laas.fr
Current job title and size of the research group: Full time associate researcher (Chargé de Recherche CNRS) in the MAC group (16 permanent staff)

2/ Highest obtained degree (with indication of place and date)

PhD, Université des Sciences et Technologies de Lille & Ecole Centrale de Lille, Lille, October 2006.

3/ Professional activity in the last 5 years

Research activities: Time-delay systems; Sampled-data systems; Hybrid dynamical systems; Control theory and applications of systems with limited information.
Invited Researcher: None

4/ Other duties/ positions

Associate Editor: None
CEB (conference editorial board): IEEE (for American Control Conference (ACC), Conference on Decision and Control (CDC), European Control Conference (ECC)).
Technical Committee (TC): Member of numerous IPC of international conference (ACC, CDC, ECC...). Member of the TC on Networked Systems and TC on Time Delay Systems of IFAC (International Federation of Automatic Control).
Committee of selection: Associate professor position Orsay-L2S (2012), University of Lille (2013).
Evaluation of projects. NWO, The Netherlands (2015), ANR national project (2015-2016), ERC PE7 Starting Grants 2014.

5/ Awards, fellowships and external recognition

Best French PhD award delivered by the GdR MACS, 2006..

6/ Ongoing funded research projects with dates, titles, sources of funding

ANR JCJC SCIDiS: Stability and Control of Infinite Dimensional Systems (2015-2019)

7/ Projects approved in the least 5 years

DELSYS (2011-2015), Leader : A. Seuret: “Research network on time-delay systems”, funded by CNRS, in collaboration with *LAAS, L2S, GIPSA-Lab, TUM (Munich, Germany), KTH (Stockholm, Sweden), Kent Univ. (UK), KU Leuven (Belgium), Ancona Univ. (Italy).*
LimICoS (2013-2016), Leader: S. Tarbouriech: “Limited Information Control Systems”, funded by ANR, in collaboration with *LAGEP, GIPSA-lab, L2S.*
ADNEC project (2013-2014), Leader: S. Tarbouriech: “Analysis and Design Methods for Networked and Embedded Control Systems”, funded by STIC-AmSud , in collaboration with GIPSA-lab (France), UFRGS, CEFET (Brazil), University of Conception (Chile).
UPTRIP (2014-2015), Leader : A. Seuret: “Conception of a controlled tripode with 4 axes for audiovisual applications” funded by Region Midi-Pyrenees , in collaboration with *LAAS-CNRS, Comat Aerospace Toulouse*. (2014-2015)
SynC (2014-2015), Leader : A. Seuret: “Software for the analysis and design of controller for complex systems”, funded by Toulouse Tech Transfer in collaboration with *LAAS-CNRS, Toulouse Tech Transfer, Comat Aerospace Toulouse.*

8/ Publications

8.1 – Highlight the most important publications related to the project theme

- A. Seuret, ``A novel stability analysis of linear systems under asynchronous samplings", in Automatica, Vol. 48(1), pp. 177-182, 2012.

- A. Seuret and F. Gouaisbaut, ``Wirtinger-based integral inequality : Application to time-delay systems", Automatica, vol.49(9), pp. 2860-2866, 2013.
- A. Seuret and F. Gouaisbaut, ``Hierarchy of LMI conditions for the stability analysis of time-delay systems", in Systems & Control Letters, Vol. 81, p 1-7 2015.
- A. Seuret, C. Prieur, S. Tarbouriech, L. Zaccarian. LQ-based event-triggered controller co-design for saturated linear systems, Automatica, vol 74, pp.47-54, 2016.
- L. Hetel, C. Fiter, H. Omran, A. Seuret, E. Fridman, J.-P. Richard, S.-I. Niculescu, "Recent developments on the stability of systems with aperiodic sampling: an overview", in Automatica, vol76(2), 309-335, 2017.

8.2 – Publications in cooperation with the project partners

- A. Seuret and J.M. Gomes Da Silva, Taking into account period variations and actuators saturation in sampled-data systems", in System & Control Letters, vol. 61(12), pages 1286-1293, 2012.
- A. Seuret, C. Prieur and N. Marchand, Stability of nonlinear systems by means of event-triggered sampling algorithms, IMA Journal of Mathematical Control and Information, 2013.
- J.M. Gomes Da Silva Jr., I. Queinnec, A. Seuret and S. Tarbouriech, ``Stability Analysis of Dynamic Output Controllers under Aperiodic Sampling and Input Saturation", in the Proceedings of the 21st International Symposium on Mathematical Theory of Networks and Systems (MTNS 2014), Groningen, The Netherlands, 2014.
- J. M. Gomes da Silva, I. Queinnec, A. Seuret, and S. Tarbouriech. Regional stability analysis of discrete- time dynamic output feedback under aperiodic sampling and input saturation. IEEE Trans. on Automatic Control, 61(12), pp. 4176–4182, 2016.
- S. Tarbouriech, A. Seuret, J. M. Gomes da Silva, and D. Sbarbaro. Observer-based event-triggered control co-design for linear systems. IET Control Theory Applications, 10(18):2466–2473, 2016.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

A. Arce Rubio, (Post-doc, 2013-2014) ``Collaborative control for load carrying drones''.

P. Andrianiaina: (PhD, 2010-2012) ``Robust control under slackened real-time constraints'' (with Airbus) Toulouse France.

G. Rodrigues de Campos: (PhD, 2009-2012) ``Cooperative control through wireless networks''.

9.2 – Ongoing

M. Barreau, (2016-2019) ``Lyapunov analysis of distributed parameter systems''.

M. Safi, (2015-2018) ``Stability and control of innite dimensional systems''.

F. Niel, (2014-2017) ``Distributed control: Application to load carrying drones''.

CV of Isabelle Queinnec

1/ Personal data

Name: QUEINNEC Isabelle
Birth date: 30/11/1964
Professional address (with telephone and e-mail):
LAAS-CNRS, 7 avenue du Colonel Roche, BP54200, 31400 Toulouse, France
Tel: +33 (0)5 61 33 64 77, Email: queinnec@laas.fr
Current job title and size of the research group: Full time researcher (Directeur de Recherche CNRS) in the MAC group (16 permanent staff)

2/ Highest obtained degree (with indication of place and date)

Habilitation à Diriger des Recherches (HDR), Université Paul Sabatier, Toulouse, Mai 2000.

3/ Professional activity – Last 5 years

- Robust control of systems with uncertain parameters and disturbances and submitted to input, state and communication constraints
- Modelling and parameter estimation
- Applications to aeronautical systems, to health and to biological wastewater treatment processes

4/ Other duties/ positions – Last 5 years

- Member of IFAC TC-8.4 and TC 8.3, from 2002 and 2005, respectively
- AE of IET Control Theory and Applications from 2014, of Nonlinear Analysis: Hybrid Systems (NAHS) from 2016
- Member of the IEEE-CSS Conference Editorial board from 2013
- Member of the scientific council of the INS2I-CNRS
- Head of the Department DO (Decision and Optimization) of LAAS (Composed of 3 teams (among which the MAC team), 40 permanent members) from April 2016
- Director of the GDR MACS (CNRS organization for animation and structuration of the French community in control – 2000 members)

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding

- SEFA-IKKY project. With ONERA, AIRBUS and Dassault. Grant from DGA. Validation of hybrid control schemes in civil aircraft. 2016-2018 (3 years)

7/ Projects approved in the least 5 years

- ToulouseTechTransfert Maturation Projet (pre-industrialisation concept). Developpement of a matlab toolbox for LMI-baed
- French ANR LIMICOS. Control of limited information systems. 2013-2016 (4 years)
- Midi-Pyrénées Region project UPTRIP with Enterprise COMAT. Control of a quadripole. 2014-2015 (2 years)

8/ Publications

8.1 – Highlight the most important publications in the last 5 years related to the project theme

- G. Valmorbida, L. Zaccarian, S. Tarbouriech, I. Queinnec, A. Papachristodoulou. Nonlinear static state feedback for saturated linear plants via a polynomial approach. *IEEE Trans. on Automatic Contro*l, 62(1), 469-474, 2017.
- L. Douat, I. Queinnec, G. Garcia, M. Michelin, F. Pierrot, S. Tarbouriech. Identification and vibration attenuation for the parallel robot Par2. *IEEE Trans. on Control Systems Technology*, 22(1), 190-200, 2014.
- S. Tarbouriech, I. Queinnec, C. Prieur. Stability analysis and stabilization of systems with input backlash. *IEEE Trans. on Automatic Control*, 59(2), 488-494, 2014.
- C. Olalla Martinez, R. Leyva, I. Queinnec, D. Maksimovic. Robust gain-scheduled control of switched-mode DC-DC converters. *IEEE Trans. on Power Electronics*, 27(6), 3006-3019, 2012.
- S. Zabi, I. Queinnec, S. Tarbouriech, M. Mazerolles. Controller design for analgesia with quantized pupil size variation output and saturating infusion rate. *IFAC Symposium on Nonlinear Control Systems (NOLCOS)*, Monterey (USA), august 23-25, pp.760-765, 2016.
- I. Queinnec, S. Tarbouriech, S. Gayadeen, L. Zaccarian. Static anti-windup design for discrete time large-scale cross-directional saturated linear control systems. *IEEE Conference on Decision and Control (CDC)*, Osaka (Japan), december 15-18, 2015.

8.2 – Publications in cooperation with the project partners

- J.-M. Gomes da Silva Jr, I. Queinnec, A. Seuret, S. Tarbouriech. Regional stability analysis of discrete-time dynamic output feedback under aperiodic sampling and input saturation. *IEEE Trans. on Automatic Control*, 61(12), 4176-4182, 2016.
- J. M. Gomes da Silva Jr., I. Queinnec, A. Seuret, S. Tarbouriech. Stability analysis of dynamic output controllers under aperiodic sampling and input saturation. *International Symposium on Mathematical Theory of Networks and Systems (MTNS'2014)*, Groningen (The Netherlands), july 7-11, 2014.
- S. Tarbouriech, G. Garcia, J.M. Gomes da Silva Jr, I. Queinnec. *Stability and Stabilization of Linear Systems with Saturating Actuators*. Springer, London (UK), 451p., No ISBN 978-0-85729-940-6, August 2011.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

- S. Zabi (direction). PhD Université Paul Sabatier, Toulouse, 12/2016.
- M. Pocquet (co-direction). PhD INSA, Toulouse. 01/2015.

9.2 – Ongoing

CV of Luca Zaccarian

1/ Personal data
Name: Luca Zaccarian
Birth date: February 20, 1969
Professional address (with telephone and e-mail): GLAAS-CNRS, MAC group, 7 Avenue du Colonel Roche, 31400 Toulouse, France. Phone: +33 5 6133 7890 – Email: zaccarian@laas.fr
Current job title and size of the research group: Full time researcher (Directeur de Recherche CNRS) in the LAAS-CNRS, MAC group (15 permanent staff)

2/ Highest obtained degree (with indication of place and date)
PhD in Automatic Control in June 2000, given by the University of Rome, Tor Vergata.

3/ Professional activity in the last 5 years
Research activities: Hybrid and nonlinear dynamical systems with mechatronic applications.

4/ Other duties/ positions
Associate Editor: IEEE Transactions on Automatic Control, Automatica.
CEB (conference editorial board): European Control Conference (ECC)).
Technical Committee (TC): Member of numerous IPC of international conference (ACC, CDC, ...). Member of the TC on Nonlinear Systems of IFAC (International Federation of Automatic Control)), Member of the TC on Nonlinear Systems and Hybrid systems (IEEE).

5/ Awards, fellowships and external recognition
2001 O. Hugo Schuck best paper award given by the AACC. IEEE Fellow since 2016.

6/ Ongoing funded research projects with dates, titles, sources of funding
PowerLyap research fund of control technology transfer, funded by CaRiTRo (Trento, Italy) from 2017 to 2018 (2 years). 2016-2017 Grant "GRASP: GRAph-based Strategies for multi-agent cooPerative robotics" (co-coordinated with Antonio Franchi) funded by the LAAS-CNRS, Carnot post-doctoral positions.

7/ Projects approved in the least 5 years
Bilateral project CNRS-University of Oxford on "Anti-windup synthesis for rate-limited actuators on synchrotrons" (2014). Research grant "Optimization techniques for hybrid dynamical systems: from theory to application" funded by the University of Trento. (2015-2017).

8/ Publications
8.1 – Highlight the most important publications related to the project theme
A. S. Galeani, A. Serrani, G. Varano, and L. Zaccarian. On input allocation-based regulation for linear over-actuated systems. Automatica, 52:346–354, 2015.
B. C. Prieur, A.R. Teel, and L. Zaccarian. Relaxed persistent flow/jump conditions for uniform global asymptotic stability. IEEE Transactions on Automatic Control, 59(10):2766–2771, 2014.
C. F. Fichera, C. Prieur, S. Tarbouriech, and L. Zaccarian, LMI-based reset Hinf analysis and design for linear continuous-time plants, IEEE Trans. Aut. Control, vol. 61 (12), pp. 4157-4163, 2016.
D. F. Forni, S. Galeani, D. Nešić, and L. Zaccarian. Event-triggered transmission for linear control over communication channels. Automatica, 50(2):490–498, 2014.
E. D. Nešić, A.R. Teel, G. Valmórbida, and L. Zaccarian. Finite gain Lp stability for hybrid dynamical systems. Automatica, 49(8):2384–2396, 2013.

8.2 – Publications in cooperation with the project partners
- G. Valmorbida, L. Zaccarian, S. Tarbouriech, I. Queinnec, and A. Papachristodoulou. Nonlinear static state feedback for saturated linear plants via a polynomial approach. IEEE Transactions on Automatic Control, (1):469–474, 2017.

- C. Prieur, S. Tarbouriech, L. Zaccarian. Lyapunov-based hybrid loops for stability and performance of continuous-time control systems, Automatica, Vol.49, No2, pp.577-584, February 2013.
- V. Andrieu, C. Prieur, S. Tarbouriech, and L. Zaccarian. A hybrid scheme for reducing peaking in high-gain observers for a class of nonlinear systems. Automatica, pages 138–146, 2016.
- A. Seuret, C. Prieur, S. Tarbouriech, L. Zaccarian. LQ-based event-triggered controller co-design for saturated linear systems, Automatica, vol 74, pp.47-54, 2016.
- C. Albea-Sanchez, A. Seuret, and L. Zaccarian. Activation and consensus control of a three-node server network cluster via hybrid approach. Nonlinear Analysis: Hybrid Systems, pages 16–30, 2016.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

May 2017. PhD Advisor of Andrea Bisoffi: Weak Lyapunov Functions for Hybrid Dynamical Systems: Applications to Electrical and Mechanical Systems. University of Trento. Currently post-doc at KTH Stocholm, Sweden.

October 2016. PhD Advisor of Laura Dal Col: On Distributed Control Analysis and Design for Multi-Agent Systems subject to Limited Information. Laboratoire d'Analyse et Architectures des Systemes (LAAS-CNRS). Currently Working at SCANIA in Stocholm, Sweden.

October 2013. Unofficial co-supervisor of Francesco Fichera: Lyapunov techniques for a class of hybrid systems and reset controller syntheses for continuous-time plants. Laboratoire d'Analyse et Architectures des Systemes (LAAS-CNRS). Currently at CEA (Paris, France).

2017. Supervisor of Silvia Donnarumma, post-doc at the University of Trento on control of Power Split transmission systems.

2016. Co-supervisor of Michele Furci, post-doc at the LAAS-CNRS on nonlinear control of UAV systems.

9.2 – Ongoing

Matteo Cocetti, Reset and hybrid control systems. Doble degree between LAAS-CNRS and University of Trento. Co-supervised with Sophie Tarbouriech.

Fabien Niel, Control of airfoil using LMI-based techniques. LAAS-CNRS. Co-supervised with Alexandre Seuret.

CV of Giorgo Valmorbida

1/ Personal data

Name: Giorgio VALMORBIDA
Birth date: 09 December 1981
Professional address (with telephone and e-mail): Laboratoire des Signaux et Systemes, Departement d'Automatique, CentraleSupelec Telephone3, rue Joliot Curie, 91192 Gif-sur-Yvette France ; email : giorgio.valmorbida@l2s.centralesupelec.fr
Current job title and size of the research group: Enseignant-Chercheur. Currently supervising 2 masters students and co-supervising one PhD student.

2/ Highest obtained degree (with indication of place and date): Docteur en Automatique, 8 juillet 2010 Toulouse, France.

3/ Professional activity in the last 5 years:

January 2013 to September 2015 - Post-Doctoral Research Assistant. University of Oxford, Department of Engineering Science, Oxford, United Kingdom. Projet: Sum-of-Squares Approach to Global Stability and Control of Fluid Flows (Approches Somme de Carrées pour la Stabilité Globale et Commande d'Ecoulements de Fluides).

September 2010 to June 2012 - Post-Doctorat (Assegnista di Ricerca). Universit`a degli Studi di Roma - "Tor Vergata", Dipartimento di Informatica, Sistemi e Produzione, Roma, Italia: Nonlinear and Optimal Approaches for the Control of Nonlinear Polynomials Plants with Saturating Inputs and/or Outputs.
(Approches Optimaux et Non-linéaires pour la Commande des Systèmes Polynômiaux avec Saturation en Entrées et/ou Sorties).

4/ Other duties/ positions

June to August 2011 – Visiting Researcher, Johannes Kepler Université de Linz, Austria. Recherche : Projets d'Application de l'Institute for Design and Control of Mechatronical Systems.

5/ Awards, fellowships and external recognition

September 2013 to September 2015 - Junior Research Fellow. University of Oxford, Somerville College, Oxford, United Kingdom. Fulford Junior Research Fellowship.

6/ Ongoing funded research projects with dates, titles, sources of funding

Groupe de Recherche Internationale (GdRI) – SpaDisCo (Systèmes à Paramètres Distribués et Contraintes - International Research Group Distributed Parameter Systems and Constraints). Funding from June 2017 to November 2020. Jointly funded by the participating institutions and mainly funded by the CNRS.

7/ Projects approved in the least 5 years

8/ Publications

8.1 – Highlight the most important publications related to the project theme

VALMORBIDA, G. ; DRUMMOND R.; DUNCAN, S. . Regional Analysis of Slope Restricted Lur'e Systems. IEEE Transactions on Automatic Control, Submitted.

VALMORBIDA, G. ; GARULLI, A. ; ZACCARIAN, L. . Regional L2m-gain analysis for linear saturating systems. Automatica,, v. 76, p. 164-168, 2017.

VALMORBIDA, G. ; ANDERSON, J. Region of Attraction Estimation Using Invariant Sets and Rational Lyapunov Functions. Automatica, v. 75, p. 37-45, 2017.

VALMORBIDA, G. ; ZACCARIAN, L. ; TARBOURIECH, S. ; QUEINNEC, I. ; PAPACHRISTODOULOU,A. A polynomial approach to nonlinear state feedback stabilization of saturated linear systems. IEEE Transactions on Automatic Control, v. 62(1), p. 469 - 474, January, 2017.

VALMORBIDA, G. ; AHMADI, M. ; PAPACRISTODOULOU, A. Stability Analysis for a Class of Partial Differential Equations via Semi-Definite Programming. IEEE Transactions on Automatic Control, v. 61(6), p. 1649-1654 , June, 2016.
NESIC, D. ; TEEL, A. VALMORBIDA, G. ; ZACCARIAN ; L. . Finite Gain Lp Stability for Hybrid Dynamical Systems. Automatica (Oxford), v. 49(8), p. 2384- 2396, 2013.
VALMORBIDA, G. ; TARBOURIECH, S. ; GARCIA, G. Synthesis of non-linear control laws for saturating polynomial systems. IEEE Transactions on Automatic Control, v. 58(7), p. 1758-1770, 2013.

8.2 – Publications in cooperation with the project partners

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

September 2013 to October 2016 Dr. Mohamadreza AHMADI, “Analysis of Systems Described by Partial Differential Equations Using Convex Optimization”. Department of Engineering Science (Clarendon Scholarship) Co-supervised with Prof. Antonis PAPACHRISTODOULOU

9.2 – Ongoing

November 2016 to present date : Mr. Nathan MICHEL, “Commande prédictive robuste pour un drone miniature en environnement encombré” ´Ecole Doctorale STIC, CentraleSupelec, ONERA. Co-supervised with Sylvain BERTRAND, Sorin OLARU and Didier DUMUR.

CV of Christophe Prieur

1/ Personal data

Name: Christophe Prieur

Birth date: May 14, 1974

Professional address (with telephone and e-mail): Gipsa-lab, Department of Automatic Control, Grenoble Campus, 11 rue des Mathématiques, BP 46, 38402 Saint Martin d'Hères Cedex. Phone: +33 4 76 82 71 71– Email= Christophe.prieur@gipsa-lab. fr

Current job title and size of the research group: Full time researcher (Directeur de Recherche CNRS) in the Gipsa-lab, Sysco group (13 permanent staff)

2/ Highest obtained degree (with indication of place and date)

Habilitation à Diriger des Recherches (HDR), Université Paul Sabatier, Toulouse, November 2009.

3/ Professional activity in the last 5 years

Research activities: Hybrid dynamical systems (reset systems, switched systems); Control of distributed parameter systems.

4/ Other duties/ positions

Associate Editor: IMA J. Math. Control Information (2008-2015), IEEE Transactions on Automatic Control (IEEE-TAC, 2011), IEEE Control Systems Technology (IEEE-TCST, 2015-), European Journal of Control (EJC, 2013-), Senior Editor for IEEE Control Systems Letters (2017-).

CEB (conference editorial board): IEEE (for American Control Conference (ACC), Conference on Decision and Control (CDC), European Control Conference (ECC)).

Technical Committee (TC): Member of numerous IPC of international conference (ACC, CDC, ...). Member of the TC on Nonlinear Systems and TC on Robust Control of IFAC (International Federation of Automatic Control)), Member of the TC on Distributed parameter systems (IEEE).

Research management. Automatic Control department chair of the Gipsa-lab (around 120 researchers), since Jan. 2016

5/ Awards, fellowships and external recognition

IMA Fellow (”Fellow of Institute of Mathematics and its Applications”), UK, since 2011. 2015: IFAC French Award for Service. IEEE Senior Member since 2016.

6/ Ongoing funded research projects with dates, titles, sources of funding

ECOS-Sud with Chile (Jan. 2017-Dec. 2020): Control of distributed parameter systems with applications in physical networks, funded by ECOS Sud (France) and CONICYT (Chile).

7/ Projects approved in the least 5 years

LimICoS project (2013-2016): Limited Information Control Systems, funded by ANR, in collaboration with LAGEP, LAAS-CNRS, L2S. MATH-Amsud project with CONICYT (Chile), CNRS (France), CAPES (Brazil), and CMM (Chile): Control Systems and Identification Problems.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

- Y. Tang, C. Prieur, and A. Girard, Singular perturbation approximation of linear hyperbolic systems of balance laws, IEEE Trans. Aut. Control, vol. 61, 10, pp. 3031-3037, 2016.
- S. Tarbouriech, I. Queinnec, C. Prieur. Stability analysis and stabilization of systems with input backlash, IEEE Transactions on Automatic Control, vol.59, no.2, pp.488-494, February 2014.
- F. Fichera, C. Prieur, S. Tarbouriech, and L. Zaccarian, LMI-based reset Hinf analysis and design for linear continuous-time plants, IEEE Trans. Aut. Control, vol. 61 (12), pp. 4157-4163, 2016.
- A. Tanwani, C. Prieur, and M. Fiacchini, Observer-based feedback stabilization of linear systems with event-triggered sampling and dynamic quantization, Systems and Control Letters, vol. 94, pp. 46-56, 2016.

8.2 – Publications in cooperation with the project partners

- A. Seuret, C. Prieur, and N. Marchand, Stability of non-linear systems by means of event-triggered sampling algorithms, IMA Mathematical Control & Information, vol. 31, 3, pp. 415-433, 2014.
- C. Prieur, S. Tarbouriech, L. Zaccarian. Lyapunov-based hybrid loops for stability and performance of continuous-time control systems, Automatica, Vol.49, No2, pp.577-584, February 2013.
- C. Prieur, S. Tarbouriech, J.-M. Gomes da Silva Jr. Wave Equation With Cone-Bounded Control Laws, IEEE Transactions on Automatic Control, Volume 61, Issue 11, pp.3452-3463, November 2016.
- A. Seuret, C. Prieur, S. Tarbouriech, L. Zaccarian. LQ-based event-triggered controller co-design for saturated linear systems, Automatica, vol 74, pp.47-54, 2016.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Francesco Fichera, Lyapunov techniques for a class of hybrid systems and reset controller syntheses for continuous-time plants, with S. Tarbouriech, 2010-2013. (Now Research-engineer at Parrot, Paris (France).)

Humberto Stein Shiromoto, Stabilization under local and global constraints, with V. Andrieu, 2011-2014. (Now Post-doc at The University of Sydney (Australia).)

Pierre-Olivier Lamare, Control of hyperbolic systems by Lyapunov analysis, with A. Girard, 2012-2015. (Now post-doc at INRIA Sophia-Antipolis (France).)

Ying Tang, Stability analysis and Tikhonov approximation for linear singularly perturbed hyperbolic systems, with A. Girard, 2012-2015. (Now post-doc at University of Lorraine, Nancy (France).)

Bojan Mavkov, Control of coupled transport in tokamak plasmas, with E. Witrant, 2013-2017

Andre Caldeira, Dynamic boundary control of coupled PDE-ODE systems, with D. Coutinho, co-tutelle with Univ. of Florianopolis (Brazil), 2014-2017.

9.2 – Ongoing

Swann Marx, Control of nonlinear systems, with V. Andrieu, 2014-

Nicolás Espitia, Event-based control of networks modeled by infinite-dimensional systems, with A. Girard and N. Marchand, 2014-

Alexandre Vieira, Non-smooth dynamical systems, with B. Brogliato, 2015-

Christophe Roman, Boundary control of wave equation with nonlinearity, with D. Bresch-Pietri and O. Sename, 2015-

Charles-Ivan Chesneau, Observers synthesis, with M. Hillion, 2015-

CV of Mirko Fiacchini

1/ Personal data

Name: Mirko Fiacchini

Birth date: July 22, 1977

Professional address (with telephone and e-mail): Gipsa-lab, Department of Automatic Control, Grenoble Campus, 11 rue des Mathématiques, BP 46, 38402 Saint Martin d'Hères Cedex. Phone: +33 (0)4 76 82 62 25 - Email= mirko.fiacchini@gipsa-lab. fr

Current job title and size of the research group: Full time researcher (Chargé de Recherche CNRS) in the Gipsa-lab, Sysco group (13 permanent staff)

2/ Highest obtained degree (with indication of place and date)

PhD in automatic control, University of Seville, Spain, 2010.

3/ Professional activity in the last 5 years

Research activities: Set-theory and invariance, hybrid and switched systems, saturated systems, sampled-data systems, predictive control, biological systems

4/ Other duties/ positions

Associate Editor: IMA J. Math. Control Information (2014-2015).

CEB (conference editorial board): Publication Chair and NOC member of the 1st IFAC Workshop on LPV Systems, 2015; Co-organizer of the 1st edition of the "Journees de l'Automatique GDR MACS", 2015; IPC member for the ECC15; Co-organizer and SC of the 35th International Summer School of Automatic Control, Grenoble, 2014, .

Technical Committee (TC): Member of the TC on Robust Control of IFAC (International Federation of Automatic Control).

Research management. Head of Sysco group of Gipsa-lab (around 13 researchers), since Jan. 2015

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding

CompACS (Computation Aware Control Systems) funded by ANR and FRAE, 2013-2017. - PRISMER (Interconnexion electrique d'hydroliennes et export de l' électricité d'une ferme), funded by ADEME, 2013-2017.

7/ Projects approved in the least 5 years

LimICoS (Synthese et analyse des systèmes avec informations limitées) funded by ANR, 2012-2016. - CATS (Computer-Assisted Therapeutic Strategies), funded by INSERM, 2013-2016. - Responsible of PERSYVAL exploratory project (Set Theory and Algorithms for Dynamical Systems) funded by PERSYVAL-lab, 2014-2015. - ArHyCo (Architectures Hybrides et Contraintes) funded by ANR, 2009-2012

8/ Publications

8.1 – Highlight the most important publications related to the project theme

F. M. Fiacchini and I.-C. Morarescu. (2016) Constructive necessary and sufficient condition for the stability of quasi-periodic linear impulsive systems. IEEE Transactions on Automatic Control, 61(9). 2512-2517

G. A. Tanwani, C. Prieur, and M. Fiacchini, Observer-based feedback stabilization of linear systems with event-triggered sampling and dynamic quantization, Systems and Control Letters, vol. 94, pp. 46-56, 2016.

8.2 – Publications in cooperation with the project partners

- M. Fiacchini, S. Tarbouriech. (2017) Control co-design for discrete-time switched linear systems. Accepted in Automatica.

- M. Fiacchini, C. Prieur, S. Tarbouriech. (2015) On the computation of set-induced control Lyapunov functions for continuous-time systems. SIAM Journal on Control and Optimization, 53(3). 1305 - 1327.
- M. Fiacchini, S. Tarbouriech, C. Prieur. (2012) Quadratic stability for hybrid systems with nested saturations. IEEE Transactions on Automatic Control, 57. 1832 -1838.
- S. Tarbouriech, I. Queinnec, T. Alamo, M. Fiacchini, E. F. Camacho. (2011) Ultimate bounded stability and stabilization of linear systems interconnected with generalized saturated functions. Automatica, 47. 1473 - 1481.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Rachid Riah, 2013/2016 on the mathematical modeling of brain tumor dynamics and the design of control-based chemo and immunotherapy, with M. Alamir.

9.2 – Ongoing

CV of Diego Eckhard

1/ Personal data

Name: Diego ECKHARD
Birth date: 23 March 1984
Professional address (with telephone and e-mail): Departamento de Matemática Pura e Aplicada, Universidade Federal do Rio Grande do Sul. Av. Bento Gonçalves, 9500 - Prédio 43-111- Porto Alegre – Brasil. E-mail: diegoeck@ufrgs.br.
Current job title and size of the research group: Adjunct Professor. Currently supervising 1 PhD student, 2 masters students and 2 undergrad students.

2/ Highest obtained degree (with indication of place and date): Doutor em Engenharia Elétrica, Universidade Federal do Rio Grande do Sul, 2012.

3/ Professional activity in the last 5 years :

February 2014 to Now – Adjunct Professor at Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.
February 2013 to Februry 2014 – Adjunct Professor at Instituto Federal de Educação, Ciência e Tecnologia, Canoas, Brasil.
February 2012 to February 2013 – Professor at Centro Universitário Univates.

4/ Other duties/ positions

January to Deceber of 2012. Sandwich PhD student at Royal Institute of Technology (KTH), Stockholm, Sweden.

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding

Projeto de controladores baseado em dados para rejeição de perturbação (Data-driven control design for disturbance rejection), from 2017-2020. CNPq-Brasil. Edital Bolsa de Produtividade em Pesquisa.
Identificação, Estimação e Controle de Biorreatores Anaeróbicos (Identification, Estimation and Control of Anaerobic Biorreactors) from 2017-2020. CNPq-Brasil. Edital Universal 2016.
Projeto de controle de drone híbrido de alta capacidade (Control design of high capacity hybrid UAV), from 2017-2019. SEBRAE, Brasil. Edital SEBRAE de Inovação.

7/ Projects approved in the least 5 years

Data-driven control design for disturbance rejection.
Identification, Estimation and Control of Anaerobic Biorreactors.
Control design of high capacity hybrid UAV.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

L. Campestrini, D. Eckhard, L. A. Ch´ıa, and E. Boeira, “Unbiased MIMO VRFT with application to process control,” Journal of Process Control, vol. 39, pp. 35–49, 2016.

J. M. Gomes da Silva Jr., E. B. Castelan, J. Corso, and D. Eckhard, “Dynamic output feedback stabilization for systems with sector-bounded nonlinearities and saturating actuators,” Journal of the Franklin Institute, vol. 350, no. 3, pp. 464–484, 2013.

G. Garcia, S. Tarbouriech, J. Gomes da Silva Jr., and D. Eckhard, “Finite L2 gain and internal stabilisation of linear systems subject to actuator and sensor saturations,” IET Control Theory Applications, vol. 3, no. 7, pp. 799–812, 2009.

J. M. Gomes da Silva Jr., F. Lescher, and D. Eckhard, “Design of time-varying controllers for discrete-time linear systems with input saturation,” IET Control Theory Applications, vol. 1, no. 1, pp. 155–162, 2007.

8.2 – Publications in cooperation with the project partners

J. M. Gomes da Silva Jr., E. B. Castelan, J. Corso, and D. Eckhard, “Dynamic output feedback stabilization for systems with sector-bounded nonlinearities and saturating actuators,” Journal of the Franklin Institute, vol. 350, no. 3, pp. 464–484, 2013.

G. Garcia, S. Tarbouriech, J. Gomes da Silva Jr., and D. Eckhard, “Finite L2 gain and internal stabilisation of linear systems subject to actuator and sensor saturations,” IET Control Theory Applications, vol. 3, no. 7, pp. 799–812, 2009.

J. M. Gomes da Silva Jr., F. Lescher, and D. Eckhard, “Design of timevarying controllers for discrete-time linear systems with input saturation,” IET Control Theory Applications, vol. 1, no. 1, pp. 155–162, 2007.

A. T. Salton, D. Eckhard, J. V. Flores, G. Fernandes, and G. Azevedo, “Disturbance observer and nonlinear damping control for fast tracking quadrotor vehicles,” in 2016 IEEE Conference on Control Applications, (Buenos Aires), pp. 706–710, IEEE, 2016.

J. V. Flores, D. Eckhard, and A. T. Salton, “Modified MIMO resonant controller robust to period variation and parametric uncertainty,” in 2016 IEEE Conference on Control Applications, (Buenos Aires), pp. 1256–1261, IEEE, 2016.

J. V. Flores, D. Eckhard, and J. M. Gomes da Silva Jr., “On the tracking problem for linear systems subject to control saturation,” in 17th IFAC World congress, (Seul), pp. 14168–14173, IFAC, 2008.

D. Eckhard, J. M. Gomes da Silva Jr., S. Tarbouriech, and C. Prier, “Output dynamic feedback controller design for disturbance attenuation taking into account both sensor and actuator saturation,” in XVII Congresso Brasileiro de Automática, (Juiz de Fora), pp. –, SBA, 2008.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Walter Mendes Haselein. Identificação de parâmetros para modelos dinâmicos de biorreatores anaeróbicos. Master in Applied Mathmatics - Universidade Federal do Rio Grande do Sul. 2017.

Roger Willian Pinto da Silva. Controle de Potência de Transmissão para dispositivos WirelessHart. Master in Eletrical Engineering- Universidade Federal do Rio Grande do Sul. 2017

Michel Michelon. Problemas inversos na identificação de biorreatores e transporte de radiação. Master in Applied Mathmatics – Universidade Federal do Rio Grande do Sul. 2016. Coadvisor.

Douglas Antunes Tesch. Extensão do Iterative Feedback Tuning para sistemas em cascata com aplicação em controle de quadricópteros. Master in Eletrical Engineering - Universidade Federal do Rio Grande do Sul. 2016.

Lydia Andrea Gonzalez Chia. Aplicação e melhorias do método de controle VRFT para sistemas multivariáveis. 2015. Dissertação (Mestrado em Engenharia Elétrica) - Universidade Federal do Rio Grande do Sul. 2015. Coadvisor.

9.2 – Ongoing

Roger Willian Pinto da Silva. Data-driven methods for disturbance rejection. PhD in Electrical Engineering.

Emerson Christ Boeira. Virtual Reference Feedback Tuning multivariável utilizando técnicas bayesianas. Master in Electrical Engineering.

Camilla Da Silva Poleto. Estimação de estados de biorreatores anaeróbicos. Master in Applied Mathmatics.

CV of Jeferson Vieira Flores

1/ Personal data

Name: Jeferson Vieira Flores
Birth date: 25/11/1982
Professional address (with telephone and e-mail):
Av. Osvaldo Aranha, 103 - Centro, Porto Alegre - RS, Brazil, ZIP 90020-090
E-mail: jeferson.flores@ufrgs.br
Phone: +55 51 33083291
Current job title and size of the research group:
Associate professor at Universidade Federal do Rio Grande do Sul – UFRGS
Researcher in the Group of Control, Automation and Robotics – GCAR
GCAR currently has 15 researchers

2/ Highest obtained degree (with indication of place and date)
Doutor em Engenharia Elétrica – UFRGS – 2012 (Ph.D in Electrical Engineering)

3/ Professional activity in the last 5 years
2012 – 2014: Associate professor at Pontifícia Universidade Católica do Rio Grande do Sul
Since 2014: Associate Professor at UFRGS

4/ Other duties/ positions
Researcher of CNPq/Brazil (National Council for Scientific and Technological Development), level 2

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding
2014 – 2017: Control methods for load reduction in wind turbines – funded by CNPq;
2016 – 2019: Internal model control design applied to three-phase uninterruptible power supplies – funded by Schneider Electric (CP Eletrônica);

7/ Projects approved in the least 5 years
See the projects in item 6/.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

- FLORES, JEFERSON V.; PEREIRA, LUIS FERNANDO A. ; BONAN, GUILHERME ; COUTINHO, DANIEL F. ; GOMES DA SILVA, JOÃO MANOEL . A systematic approach for robust repetitive controller design. Control Engineering Practice, v. 54, p. 214-222, 2016.

- GOMES DA SILVA JR, J. M.; MORAES, V. M. ; FLORES, J. V. ; PALMEIRA, A. H. K. . Sampled-data LPV Control: a Looped Functional Approach. Proc. of the 1st IFAC Workshop on Linear Parameter Varying systems (LPV'2015), 2015. p. 19-24.
- FLORES, J. V.; GOMES DA SILVA JR, J. M. ; SARTORI, R. . Tracking and rejection of periodic signals for discrete-time linear systems subject to control saturation. IET Control Theory & Applications (Print), v. 7, p. 363-371, 2013.
- FLORES, J. V.; DA SILVA, J. M. G. ; PEREIRA, L. F. A. ; SBARBARO, D. G. . Repetitive Control Design for MIMO Systems With Saturating Actuators. IEEE Transactions on Automatic Control (Print), v. 57, p. 192-198, 2012.
- FLORES, J V; GOMES DA SILVA JR, J. M. ; SEURET, A. . Static Anti-Windup Synthesis for Linear Systems with Time-Varying Input Delays. Proceedings of the 18th IFAC World Congress, 2011.

8.2 – Publications in cooperation with the project partners

- FLORES, J. V.; GOMES DA SILVA, , J. M. ; SBARBARO, D. ; TURNER, M. C. ; SALTON, A. T. . Antiwindup Design for Zero-Phase Repetitive Controllers. Journal of Dynamic Systems, Measurement, and Control, v. 137, p. 094503, 2015.
- FLORES, J. V.; DA SILVA, J. M. G. ; PEREIRA, L. F. A. ; SBARBARO, D. G. . Repetitive Control Design for MIMO Systems With Saturating Actuators. IEEE Transactions on Automatic Control (Print), v. 57, p. 192-198, 2012.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Guilherme Keiel –Discrete-time resonant controllers applied to uninterruptible power supplies, Master thesis, 2016;

Charles Lorenzini – A resonant-repetitive approach applied to uninterruptible power supplies, Master thesis, 2015;

9.2 – Ongoing

Master:

Gabriel Flores – Anti-windup design for resonant controllers robust to period variation;

Vicente Costamilan da Cunha – Data-driven control of uninterruptible power supplies;

Antônio Zani – Chaotic synchronization of discrete-time/ hybrid systems;

Ph.D:

Rafael da Silveira Castro – Internal model control for a class of nonlinar systems

CV of Pedro Luis Dias Peres

1/ Personal data
Name: Pedro Luis DIAS PERES
Birth date: 08 January 1960
Professional address (with telephone and e-mail): School of Electrical and Computer Engineering, University of Campinas, Av. Albert Einstein, 400, 13083-852 Campinas-SP-BRAZIL, Phone (+55) 19 35213759, e-mail: peres@dt.fee.unicamp.br
Current job title and size of the research group: Professor. Group of 10 people.

2/ Highest obtained degree (with indication of place and date):
Docteur en Automatique, December 14th, 1989, Toulouse, France

3/ Professional activity in the last 5 years :
Professor at the School of Electrical and Computer Engineering, University of Campinas.

4/ Other duties/ positions
May 2013 to April 2017, Head of the Graduate Program in Electrical Engineering from the School of Electrical and Computer Engineering, University of Campinas

5/ Awards, fellowships and external recognition
PRIX CNRS d'Automatique (1989)

6/ Ongoing funded research projects with dates, titles, sources of funding

7/ Projects approved in the least 5 years

8/ Publications
8.1 – Highlight the most important publications related to the project theme

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Discretisation and control of polytopic systems with uncertain sampling rates, and network-induced delays, International Journal of Control, Vol. 87, No. 11, November 2014, pp. 2398--2411, DOI: 10.1080/00207179.2014.923585.

C. F. Morais, M. F. Braga, R. C. L. F. Oliveira, P. L. D. Peres,
H-infinity state feedback control for MJLS with uncertain probabilities, Automatica, Vol. 52, No. 2, February 2015, pp. 317--321, DOI: 10.1016/j.automatica.2014.12.013.

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Discretization and event triggered digital output feedback control of LPV systems, Systems & Control Letters, Vol. 86, pp.54--65, December 2015, DOI: 10.1016/j.sysconle.2015.10.002

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Linear quadratic networked control of uncertain polytopic systems, International Journal of Robust and Nonlinear Control, Vol. 26, No. 11, pp. 2299--2313, July 2016, DOI: 10.1002/rnc.3411

8.2 – Publications in cooperation with the project partners
M. Parada, D. G. Sbarbaro, R. A. Borges, P. L. D. Peres,
Robust PI and PID design for first and second-order processes with zeros, time-delay and structured uncertainties, International Journal of Systems Science, Vol. 48, No. 1, pp.95--106, 2017, DOI:10.1080/00207721.2016.1160453.

G. Garcia, P. L. D. Peres and S. Tarbouriech, Assessing asymptotic stability of linear continuous time-varying systems by computing the envelope of all trajectories, IEEE Transactions on Automatic Control, Vol. 55, No. 4, pp. 998--1003, April 2010, DOI 10.1109/TAC.2010.2041679

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

4 PhD's, 1 Ms and 3 Post-docs

9.2 – Ongoing

CV of Ricardo Coração de Leão Fontoura de OLIVEIRA

1/ Personal data
Name: Ricardo Coração de Leão Fontoura de OLIVEIRA
Birth date: July 22 1978
Professional address (with telephone and e-mail): School of Electrical and Computer Engineering, University of Campinas, Av. Albert Einstein, 400, 13083-852 Campinas-SP-BRAZIL, Phone (+55) 19 35213747, e-mail: ricfow@dt.fee.unicamp.br
Current job title and size of the research group: Professor. Group of 10 people.

2/ Highest obtained degree (with indication of place and date): Doctor in Electrical Engineering, March 24th, 2006, Campinas, Brazil.

3/ Professional activity in the last 5 years :
Professor at the School of Electrical and Computer Engineering, University of Campinas.

4/ Other duties/ positions
April 2013 to March 2014, Head of the Departament of Telematics, School of Electrical and Computer Engineering, University of Campinas

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding
CNPq 305348/2016-7 (March 2017 – February 2020) - Controle e filtragem robusta de sistemas dinâmicos afetados por incertezas com aplicações
7/ Projects approved in the least 5 years

8/ Publications
8.1 – Highlight the most important publications related to the project theme

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Discretisation and control of polytopic systems with uncertain sampling rates, and network-induced delays, International Journal of Control, Vol. 87, No. 11, November 2014, pp. 2398--2411, DOI: 10.1080/00207179.2014.923585.

C. F. Morais, M. F. Braga, R. C. L. F. Oliveira, P. L. D. Peres,
H-infinity state feedback control for MJLS with uncertain probabilities, Automatica, Vol. 52, No. 2, February 2015, pp. 317--321, DOI: 10.1016/j.automatica.2014.12.013.

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Discretization and event triggered digital output feedback control of LPV systems, Systems & Control Letters, Vol. 86, pp.54--65, December 2015, DOI: 10.1016/j.sysconle.2015.10.002

M. F. Braga, C. F. Morais, E. S. Tognetti, R. C. L. F. Oliveira, P. L. D. Peres,
Linear quadratic networked control of uncertain polytopic systems, International Journal of Robust and Nonlinear Control, Vol. 26, No. 11, pp. 2299--2313, July 2016, DOI: 10.1002/rnc.3411

8.2 – Publications in cooperation with the project partners
C. Prieur, R. C. L. F. Oliveira, S. Tarbouriech, and P. L. D. Peres. Stability analysis and state feedback control design of discrete-time systems with a backlash. In Proceedings of the 2010 American Control Conference, pages 2688–2693, Baltimore, MD, USA, June 2010.

V. F. Montagner, R. C. L. F. Oliveira, P. L. D. Peres, S. Tarbouriech, and I. Queinnec. Gain-scheduled controllers for linear parameter-varying systems with saturating actuators: LMI-

based design. In Proceedings of the 2007 American Control Conference, pages 6067–6072, New York, NY, USA, July 2007.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

3 PhD's, 2 Ms

9.2 – Ongoing

CV of Matheus Souza

1/ Personal data
Name: Matheus SOUZA
Birth date: 29 March 1990
Professional address (with telephone and e-mail): School of Electrical and Computer Engineering, University of Campinas, Av. Albert Einstein, 400, 13083-852 Campinas-SP-BRAZIL, Phone (+55) 19 35213772, e-mail: msouza@.fee.unicamp.br
Current job title and size of the research group: Assistant Professor. Group of 7 people.

2/ Highest obtained degree (with indication of place and date): PhD in Electrical Engineering, April 24th, 2015, Campinas, Brazil

3/ Professional activity in the last 5 years :
Post-Doctoral Research Fellow at the School of Electrical and Electronic Engineering, Univeristy College Dublin.
Assistant Professor at the School of Electrical and Computer Engineering, University of Campinas.

4/ Other duties/ positions

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding
A contribution to Sampled-Data and Switched Systems Control (Feb 2017 – Feb 2019), São Paulo Research Foundation (FAPESP) grant 2016/19504-7.

7/ Projects approved in the least 5 years

8/ Publications
8.1 – Highlight the most important publications related to the project theme

M Souza and JC Geromel. H2 dynamic output feedback control for local sensor – remote actuator networks. IMA Journal of Mathematical Control and Information, 33, pp. 239 – 256, 2016.

JC Geromel and M Souza. On an LMI approach to optimal sampled-data state feedback control design. International Journal of Control, 88, pp. 2369 – 2379, 2015.

M Souza, JC Geromel, P Colaneri, RN Shorten. Discretisation of sparse linear systems: An optimization approach. Systems and Control Letters, 80, pp. 42 – 49, 2015.

M Souza, AR Fioravanti and JC Geromel. H2 sampled-data filtering of linear systems. IEEE Transactions on Signal Processing, 62, pp. 4839 – 4846, 2014.

M Souza, GS Deaecto, JC Geromel and J Daafouz. Self-triggered linear quadratic networked control. Optimal Control Applications and Methods, 35, pp. 524 – 538, 2014.

8.2 – Publications in cooperation with the project partners

9/ Theses oriented and post-doctoral fellows supervised
9.1 – Finished/defended in the last 5 years

9.2 – Ongoing
3 MSc.s

CV of Valter Júnior de Souza LEITE

1/ Personal data

Name: Valter Júnior de Souza LEITE
Birth date: 20 march 1972
Professional address (with telephone and e-mail): Department of Mechatronics Engineering, Federal Center of Technologial Education of Minas Gerais (CEFET-MG) - campus Divinopolis, Av. Alvares Azevedo, 400, Divinopolis-MG-Brazil, Phone (+55) 37 3229-1171 / (+55) 37 9 8421-0267 , e-mail: valter@ieee.org
Current job title and size of the research group: Professor. Group of 13 people, among graduate and undergraduate students.

2/ Highest obtained degree (with indication of place and date): Docteur en Automatique et Informatique Industrielle, August 23th, 2005, INSA- Toulouse, France and Doutor em Engenharia Elétrica, August 23th, 2005, UNICAMP, Campinas - SP, Brazil.

3/ Professional activity in the last 5 years :
Professor of the Department of Mechatronics Engineering of the CEFET-MG.

4/ Other duties/ positions
March 2013 to March 2015, Responsible for the undergraduate course of Mechatronics Engineering of the CEFET-MG. Since May 2014, representative of the researchers in the Board of Directors of the CEFET-MG.

5/ Awards, fellowships and external recognition
Honorable Mention from CAPES' Award of Thesis (2006). Eduacator of the Year (2015), from the city of Divinopolis (MG, Brazil).

6/ Ongoing funded research projects with dates, titles, sources of funding

7/ Projects approved in the least 5 years
Convex optimization applied to robust control systems, CNPq, 2013-2016.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

Klug, M. ; Castelan, Eugenio B. ; Leite, Valter J. S. ; Silva, L. F. P. . Fuzzy dynamic output feedback control through nonlinear Takagi-Sugeno models. Fuzzy Sets and Systems, v. 263, p. 92-111, 2015.

SILVA, LUÍS F. P. ; Leite, Valter J. S. ; Castelan, Eugênio B. ; KLUG, MICHAEL . Local Stabilization of Time-Delay Nonlinear Discrete-Time Systems Using Takagi-Sugeno Models and Convex Optimization. Mathematical Problems in Engineering (Online), v. 2014, p. 1-10, 2014.
Citações:3

LACERDA, MÁRCIO J. ; PERES, PEDRO L.D. ; OLIVEIRA, RICARDO C.L.F. ; LEITE, VALTER J.S. Delay-dependent robust H∞ filter design for state-delayed discrete-time linear systems via homogeneous polynomial matrices. IET Control Theory & Applications (Online), v. 7, p. 125-135, 2013.

8.2 – Publications in cooperation with the project partners

LEITE, V. J. S.; Tarbouriech, S. ; Peres, P. L. D. . Robust H-infinity state feedback control of discrete-time systems with state delay: an LMI approach. IMA Journal of Mathematical Control and Information, v. 26, p. 357-373, 2009.

MONTAGNER, Vinícius F ; LEITE, V. J. S. ; OLIVEIRA, Ricardo C L F ; PERES, Pedro Luis Dias . State feedback control of switched linear systems: an LMI approach. Journal of Computational and Applied Mathematics, v. 194, p. 192-206, 2006.

LEITE, V. J. S.; PERES, Pedro Luis Dias . An improved LMI condition for robust D-stability of uncertain polytopic systems. IEEE Transactions on Automatic Control (Print), v. 48, n.3, p. 500-504, 2003.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

2 PhD's (Co-supervision), 6 Ms, 13 undergraduate.

9.2 – Ongoing

1 PhD (Co-supervision), 7 Ms, 1 Post-doc and 6 undergraduate.

CV of Alejandro J. Rojas

1/ Personal data

Name: Alejandro J. ROJAS
Birth date: 22/October/1974
Professional address (with telephone and e-mail): Departamento de Ingeniería Eléctrica, Facultad de Ingeniería, Universidad de Concepción, Concepción, Chile. Teléfono: +56412661227
Current job title and size of the research group:
Profesor asociado

2/ Highest obtainened degree (with indication of place and date)

Ph.D. in Electrical Engineering, *The* university *of* Newcastle, Newcastle, Australia. Feb. 2007

3/ Professional activity in the last 5 years

Academic at the University of Concepción, Chile.

4/ Other duties/ positions

N.A.

5/ Awards, fellowships and external recognition

N.A.

6/ Ongoing funded research projects with dates, titles, sources of funding

- Proyecto Fondecyt Regular, Investigador Principal, Título: "Signal-to-Noise Ratio Constrained Control", Número 1150116, Inicio: Marzo 2015, Término: Febrero 2018. Monto total: $ 77.136.000 CLP

7/ Projects approved in the least 5 years

- Proyecto Fondecyt Regular, Investigador Principal, Título: "Signal-to-Noise Ratio Constrained Control", Número 1150116, Inicio: Marzo 2015, Término: Febrero 2018. Monto total: $ 77.136.000 CLP
- Proyecto Fondecyt de Iniciación en Investigación, Investigador Principal, Título: "*Limitations in Control over Networks*", Número 11100080, Inicio: Octubre 2010, Término: Septiembre 2013. Monto total: $ 72.037.000 CLP .

8/ Publications

8.1 – Highlight the most important publications related to the project theme

- D.U. Campos-Delgado, J.M. Luna-Rivera, **A.J. Rojas** , and C.A. Gutiérrez, *"Power Allocation in Mobile Cellular Communication under Multiplicative Noise and Interference Uncertainty",* IEEE Transactions on Control of Network Systems (ISSN: 2325-5870). Vol. PP, No.99, pp.1–11 , Accepted for publication, December 2015. DOI: 10.1109/TCNS.2015.2512323

- **A.J. Rojas**, *"Step Reference Tracking in Signal-to-Noise Ratio Constrained Feedback Control"*, International Journal of Control, Automation, and Systems (ISSN: 1598-6446), Vol.13, No.5, pp.1131–1139 , October 2015. DOI : 10.1007/S12555-013-0283-6

- D.U. Campos-Delgado, **A.J. Rojas**, J.M. Luna-Rivera, and C.A. Gutiérrez, *"Event-triggered feedback for power allocation in wireless networks",* IET Control Theory & Applications (ISSN: 1751-8644). Vol.9, No.14, pp.2066–2074 , September 2015. DOI: 10.1049/iet-cta.2014.1266

- **A.J. Rojas** and F. Lotero, *"Signal-to-Noise Ratio Limited Output Feedback Control Subject to Channel Input Quantization"*, IEEE Transactions on Automatic Control (ISSN: 0018-9286), Vol.60, No.2, pp.475–479 , February 2015. DOI: 10.1109/TAC.2014.2327452

- **A.J. Rojas**, *"Novel Insights on the Stabilizing Solution to the Continuous Time Algebraic Riccati Equation"*, International Journal of Control (ISSN: 0020-7179), Vol.87, No.11, pp.2412–2419 , November 2014. DOI: 10.1080/00207179.2014.924630

- **A.J. Rojas**, "*Explicit solution for a class of discrete-time algebraic Riccati equations*", Asian Journal of Control (ISSN: 1934-6093), Vol. 15, No. 1, pp. 132–141, January 2013. DOI: 10.1002/asjc.511

- **A.J. Rojas**, "*Stabilizability of nonminimum phase unstable plants with arbitrary multiplicity over AWGN channels*", Revista Controle & Automaçao (ISSN: 1807-0345), Vol. 23, No. 4, pp. 404–414 , July/August 2012. DOI: 10.1590/S0103-17592012000400002

- **A.J. Rojas**, "*Signal-to-noise ratio fundamental limitations in the discrete-time domain*", Systems & Control Letters (ISSN: 0167-6911), Vol.61, No.1, pp. 55-61, January 2012. DOI: 10.1016/j.sysconle.2011.09.010

- **A.J. Rojas**, "*Signal-to-Noise Ratio Fundamental Limitations in Discrete-Time Linear Output Feedback Control*", Automatica (ISSN: 0005-1098), Vol.47, No.2, pp. 376-380, February 2011. DOI: 10.1016/j.automatica.2010.10.043

8.2 – Publications in cooperation with the project partners
N.A.

9/ Theses oriented and post-doctoral fellows supervised
9.1 – Finished/defended in the last 5 years

- Ph.D. Candidate: Hugo Garcés. Research Project: "Sensado indirecto de variables dinámicas y distribuidas sobre procesos de combustión basado en análisis espectral", 2013-2015. Finished 16/03/2016.

- Ph.D. Candidate: Felipe Donoso. Research Project: "Electrocardiogram Signals Classification", 2010-2014. Finished 06/10/2014.

9.2 – Ongoing
N.A.