PROGRAM OF IEEE IFAC ICA - ACCA2021

IEEE IFAC International Conference on Automation, XXIV Congreso de la Asociación Chilena de Control Automático

Chile, March 22-26, 2021
Online Conference

Organizers

IEEE Consejo Chile
Asociación Chilena de Control Automático ACCA
IEEE Chilean Chapter on Control Systems
IEEE Chilean Chapter on SMC
IEEE Chilean Chapter on Education
International Federation on Automatic Control IFAC

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IEEE IFAC ICA ACCA 2021

Welcome by Gastón Lefranc
IEEE IFAC ICA ACCA 2021 Co-Chair

WELCOME TO

IEEE IFAC International Conference on Automation, XXIV Congreso de la Asociación Chilena de Control Automático

This Conference is organized by IEEE Consejo Chile (with its two sections: IEEE Chile Centro and Chile Sur), The Asociación Chilena de Control Automático ACCA, IEEE Chilean Chapter on Control Systems, IEEE Chilean Chapter on SMC, and IEEE Chilean Chapter on Education. Also, the Conference is recognized as an activity of IFAC, the International Federation of Automatic Control, where ACCA is an NMO organization. Our event has the lemma: **"Collaborative research for challenging times."**

This online Conference is a place for sharing knowledge, research results, and industrial applications. We expect that new ideas and projects will be discussed and, above all, collaborative research will be initiated or strengthened. In this Conference, authors will present what they have achieved in their recent investigations and receive constructive criticism to learn from each other.

The collaboration between Asociación Chilena de Control Automático (ACCA), the two IEEE Chilean Section, and its IEEE CS, SMC, Education Chilean Chapters is a long-standing one. Since 1987 we have organized technical activities such as the IEEE Chilecon Conference and the joint ACCA Congress – IEEE/IFAC ICA (International Conference on Automation). These activities were supported by Chilean Universities and sponsored by leading institutions and companies.

I want to acknowledge two dear colleagues who have been essential to attract a growing number of participants to these conferences. The enthusiasm, responsibility, and effort of Mario Fernández from the University of Talca, and President of ACCA, are highly appreciated by us all. Additionally, my brother Etienne Lefranc, who, from the university where he works, anonymously contributed the managerial experience he gained in French and Chilean companies. The three of us have created a conference model that encourages participation, economic sustainability, and high quality. Additionally, we were able to gain our colleagues' trust, create an atmosphere of camaraderie, and ensure the collaboration of most Chilean universities.

I must mention the board of directors of ACCA and IEEE Chapters for their capacities, efforts, and disposition to solve all the obstacles we faced. I invite you to attend our online sessions, discuss and agree or disagree with our guests and authors in their talks and technical sessions.

This year, we have several Keynote Speakers that will encourage collaborative research to boost our country and Latin America's development.

All of you who will participate in this Conference are the most important actors in meeting the expectations that our societies have on Engineering, such as creating new jobs and innovations for a better quality of life and more opportunities.

Gastón Lefranc,
IEEE Chile Council President,
Chair of some IEEE Chilean Chapter
IEEE IFAC ICA ACCA 2021 Co-Chair

Welcome by Mario Fernández
IEEE IFAC ICA ACCA 2021 Co-Chair

WELCOME TO

IEEE IFAC International Conference on Automation, XXIV Congreso de la Asociación Chilena de Control Automático

IEEE IFAC ICA ACCA 2021 Conference contains several tracks: Automatic Control, Instrumentation, Energy, Power Electronics, Industry, Education, Informatics, Communications; covering automation, computer engineering, biomedical engineering, power engineering, communications, computer sciences, industrial engineering. This Conference accepts papers on research, technology development, engineering applications, and innovations in education so that authors can discuss new ideas and share their works with their colleagues in the technical sessions.

Technical Sessions and Plenary Talks of Keynote Speakers will show new developments and disseminate new ideas and recent research results related to automation applications in several areas such as electrical engineering, electronics, computer engineering, biomedical engineering, process engineering, industrial engineering, and many others. We will encourage academics, professionals, and students to advance and exchange knowledge and experiences and form or consolidate friendship and research cooperation networks.

We hope this Conference will help create bridges between academics, industrial colleagues and supplying companies so that their joint and fruitful work will boost our countries' development. In addition, we expect that attendees will be motivated to create new companies or improve their environment with innovations and activities that generate more and better jobs and achieve a better quality of life.

We thank ACCA, IEEE and its Chapters, the Chilean Association of Engineeres (Colegio de Ingenieros de Chile) and AIE (Chilean Association of Electric and Electronic Industries), and especially the Board of Directors of ACCA and IEEE Chilean Chapters. This is an official IEEE conference.

I invite you to enjoy this Conference, learn, and share.

Mario Fernández,
ACCA President,
IEEE IFAC ICA ACCA 2021 Co-Chair

PREFACE OF
Ricardo Pérez and Cristián Durán
IPC CHAIRS

IEEE IFAC International Conference on Automation, XXIV Congreso de la Asociación Chilena de Control Automático

This Conference has received 204 papers that have been professionally reviewed by international and Chilean peers. The IPC (International Program Committee) has decided to accept, based on these reviewes, 148 papers. The papers come from 24 countries, from diverse areas such as automation, computer engineering, biomedical engineering, power engineering, communications, computer sciences, industrial engineering, energy, power electronics, robotics, artificial intelligence and much more. We are quite happy with the high level of the papers to be presented. Accepted papers will be published by IEEE Xplore, which is Scopus, as long as they are defended during the event. Authors must submit a PPT with audio and at least one author must be present at the session to answer the questions.

Ricardo Pérez
Cristián Durán
IPC Chairs

Honorary President of *IEEE IFAC ICA ACCA 2021*

Dra. Felisa Córdova
President of ACCA 1993-1996

Dra. Felisa Córdova

Graduated Electrical Engineer at the University of Santiago de Chile USACH. She obtained the Diplome d´Etudes Approfondis in Electronics and the degree of Docteur Ingénieur at the University of Paris XI, France. Actually, she is professor and Director of the School of Engineering at the Faculty of Engineering, University Finis Terrae UFT, Santiago, Chile.

Biosketch:

She was professor, Academic Vice Rector and Director of the Industrial Engineering Department, at the Faculty of Engineering, University of Santiago de Chile USACH. She was also Director of the Master of Science Engineering Program and Header of Management Area of the Industrial Engineering Department of, at the Faculty of Physical and Mathematical Sciences at University of Chile. Her main research interest is in Business Strategy, Operations Management, and Knowledge Management. She has participated in several national and international research projects in the fields of Robotics, AGV and Virtual Operation Systems in underground mining, also in ports. She has published many papers in conference proceedings and international indexed journals in the area of Robotics, Knowledge and Operation Management, and Neuromanagement. She has participated in the organization of national and international Conferences (ACCA, LCA, LCR, SEPROSUL, ICPR, CESA). She was past-president of the Chilean Association of Automatic Control ACCA and she was national councilor, President of the Education Committee and past Vice President of the College of Engineers of Chile. She participated as an institutional accreditation evaluator at the CNA, Chile and also in the CEAB accreditation (Washington Accord) to engineering programs, Canada. She was member of the accreditation board and now she is member of the Directory of Acredita CI.

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GENERAL PROGRAM

IEEE IFAC ICA ACCA 2021

Horarios	Monday 22, March 2021			
Chile	Room 1	room 2	room 3	room 4
13:45	Start conection			
14:00-14:30	Inauguration 30 min IEEE, ACCA Chairs			
14:45-16:15	Keynote Speaker 1	Keynote Speaker 2		
	Felisa Córdova "Cyber-social-technological-cognitive (CSTC) approach in ecosystems: trends and challenges".	Marco Ceccarelli Mechanism Design of robotic devices in treatments of COVID19 patients	Raquel Fratta Renewable Energy and Forest Conservation	
	Artificial Intelligence	Robotics		
16:30-18:00	Session T21: Automatic Control Theory 1	Session T41: Track Energy 1	Session T51: Power Electronics 1	Session T61: Instrumentation & Communications 1
	4, 5, 39, 40	8, 9, 10, 11	16, 28, 54, 59	6, 14, 32, 41

Track #,	Paper ID *ex.* T21=Track 2, session 1
T2: Automatic Control Theory	4, 5, 39, 40, 43, 58, 80, 83, 103, 112, 156, 172, 174, 179, 180, 186
T3: Automatic Control Applications	17, 18, 19, 20, 21, 31, 44, 45, 53, 56, 76, 87, 96, 99, 102, 106, 111, 114, 118, 149, 150, 167, 184, 187, 189, 194
T4: Track Energy	8, 9, 10, 11, 22, 25, 26, 27, 29, 30, 34, 61, 62, 63, 64, 72, 77, 79, 84, 88, 95, 127, 129, 144, 145, 148, 182, 183, 188, 190, 192, 197, 158, 201
T5: Power Electronics	16, 28, 54, 59, 75, 89, 90, 101, 104, 110, 123, 128, 133, 135, 137, 138, 146, 147, 155, 160, 161, 162, 165, 191, 204
T6: Instrumentation & Communication	6, 14, 32, 41, 42, 50, 55, 82, 93, 97, 100, 131, 185
T7 Informatics & Engineering Education	35, 38, 91, 105, 108, 115, 119, 120, 134, 152,157, 168, 181
T8: Industry & Other Applications	13, 37, 48, 51, 71, 74, 86, 98, 109, 117, 121, 126, 163, 166, 169, 170, 171, 173, 178, 193, 200

Horarios	Tuesday 23, March 2021			
Chile	Room 1	room 2	room 3	room 4
13:45	Start conection			
14:00-15:30	T22: Automatic Control Theory 2	T42: Track Energy 2	T52: Power Electronics 2	T62: Instrumentation & Communications 2
	43, 58, 80, 83	22, 25, 26, 27	75, 89, 90, 101	42, 50, 55, 82
15:45-17:15	T23: Automatic Control Theory 3	T43: Track Energy 3	T53: Power Electronics 3	T63: Instrumentation & Communications 3
	103, 112, 156, 172	29,30, 34, 61	104, 110, 123, 128	93, 97, 100
17:30-18:10	T24: Automatic Control Theory 4	T44: Track Energy 4	T54: Power Electronics 4	T64: Instrumentation & Communications 4
	174, 179,	62, 63	133, 135	131, 185

Horarios	Wennesday 24, March 2021			
Chile	Room 1	room 2	room 3	room 4
13:45	Start conection			
14:00-14:30	IPC Chair words			
14:30-16:15	Keynote Speaker 3	Keynote Speaker 4:	Discussion Panel	
	Robert Bishop Precision Planetary Landing with Hazard Detection and Avoidance	Pat Wheeler Transportation Electrification in a Post Covid-19 World	"Panel on technological developments for pandemic treatment" VGrimblatt, MCeccarelli, F. Lechuga E. Germany	
	Control	Power Electronics	Bio Engineering	
16:30-18:00	T31: Automatic Control Applications 1	T45: Track Energy	T55: Power Electronics 5	T71 Informatics & Engineering Education 1
	180, 186, 17, 18	64, 72, 77, 79	137, 138, 146, 147	35, 38, 91, 105

GENERAL PROGRAM (cont)

IEEE IFAC ICA ACCA 2021

Horarios	Thursday 25, March 2021			
Chile	Room 1	room 2	room 3	room 4
13:45				
14:00-15:30	T32: Automatic Control Applications 2	T46: Track Energy 6	T81 Industry & Other Applications 1	T72 Informatics & Engineering Education 2
	19, 20, 21, 31	84, 88, 95, 127	13, 37, 48, 51	108, 115, 119, 120
15:45-17:15	T33: Automatic Control Applications 3	T47: Track Energy 7	T82 Industry & Other Applications 2	T73 Informatics & Engineering Education 3
	44, 45, 53, 56	129, 144, 145, 148	71, 74, 86, 98	134, 152,157
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Horarios	Friday 26, March 2021			
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Time Zone

Sessions will be from 14 hr to 18:30 Chilean Hour

Time																				
Chile	Argentina	Paraguay	Uruguay	Brasil SP	Brasil Río	Bolivia	Perú	Ecuador	Colombia	NY	México Guad	Mexico DF	usa chicago	USA Tucson	USA LA	UK	Francia	España	Egypto	India	China shanghai
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Track T2: AUTOMATIC CONTROL (Theory)

	Monday	22	Track T21 Chair: Manuel Duarte	ROOM 1
#	Hora	Paper ID	Authores, Title	Countries
1	16:30	4	Elmer Rolando Llanos Villarreal, Andrés Ortiz Salazar, Carlos Eduardo Trabuco Dórea, José Mário Araújo, Werbet Luiz Almeida Da Silva and Vitor Manoel De Souza Pereira. Impulse elimination for singular second-order system : approach	
			Abstract: This paper considers approaches to partial eigenvalue assignment in second-order descriptor systems via proportional plus derivative plus output feedback controller. The impulse elimination approach by output feedback control is addressed by combining the eigenstructure and the closed-loop system's finite eigenstructure. More precisely, based on the desired eigenstructure, the gains controller's parametric expressions making the closed-loop system impulse-free and assigning the making the closed-loop system impulse-free and assigning the finite eigenstructure are formulated. The simulation results are provided to verify the effectiveness of the proposed method. This study presents an approach to partial eigenvalue assignment for the descriptor system where an algorithm is presented for calculated the output feedback matrix by the Sylvester equation. Sylvester equations present the theorems. Two algorithms are implemented using the Sylvester equation, and examples were presented with finally their conclusions.	BR
2		5	Elmer Rolando Llanos Villarreal, Andrés Ortiz Salazar, Carlos Eduardo Trabuco Dórea, José Mário Araújo and Paulo Victor Fernandes Vieira. Approach to partial eigenvalue assignment using Sylvester equation in system-second order	
			Abstract: The paper considers an approach to partial eigenvalue assignment in second-order descriptor systems via proportional plus derivative plus output feedback controller. It is shown that the problem is closely related to a so-called second-order Sylvester matrix equation. This study presents an approach to partial the eigenstructure assignment for the descriptor system where an algorithm is presented for calculated the output feedback matrix by equation de Sylvester. Two complete parametric methods for the proposed approach to partial eigenstructure assignment problems are presented. Both methods give simple complete parametric expressions for the feedback gains and the closed-loop eigenvector matrices. The first one mainly depends on a series of singular value decompositions. The second one utilizes the system's factorization and allows the closed-loop eigenvalues to be set undetermined and sought via specific optimization procedures. The theorems are presented using the Sylvester equations. Two algorithms are implemented using the Sylvester equation, and examples are presented with their conclusions.	BR
3		39	Yogesh V. Hote and Shivam Jain. Generalized Active Disturbance Rejection Control: Review, Applications and Challenges	
			Abstract: This paper deals with the review, applications and the challenges of the active disturbance rejection control scheme (ADRC) for linear time invariant systems. A brief review of the initial developments of nonlinear ADRC scheme and generalized ADRC (GADRC) technique is provided. Subsequently,the GADRC technique is mathematically formulated and the formulae for the tuning of controller and observer gains are given. The GADRC scheme is then applied for the control of a single axis gimbal system. The mathematical model of the gimbal system is derived. The efficacy of the GADRC is demonstrated via response comparison with linear active disturbance rejection control (LADRC) technique and single degree of freedom internal model control (IMC) approach. The robustness of the controller is verified via investigation of system response on the introduction of step and random torque disturbance. The simulation results testify the effectiveness of the proposed approach.	IN
4		40	Yogesh V. Hote. Stability Analysis of Time-Delayed Linear and Interval Systems: Applications to DC Servo Systems	
			Abstract: In frequency domain analysis, gain margin and phase margin plays a vital role in the relative stability analysis of the system. It is observed that for some class of systems, gain margin and phase margin can be the same for two different types of systems, but the closed-loop poles of the system can be different. Because of this, in this paper, it is shown that for a simplified model of position control of dc servo motor, even though there is a change in the parameters of the model, there will be no change in the gain margin and phase margin of the system. Therefore, it is shown that an additional performance measure, i.e., delay margin, is an essential criterion for the stability analysis of the system. Further, it is shown that the practical approach belongs to the interval type; therefore, a method is proposed to determine the delay margin of an interval system using Kharitonov's theorem.	IN

Track T2: AUTOMATIC CONTROL (Theory)

	Tuesday	23	Track T22 Chair: Manuel Duarte	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	14:00	43	Tainara Marques and Gilberto Reynoso-Meza. Single-objective optimization with gain scheduling control	
			Abstract: This article presents a new method for adjusting the gain-scheduling controller, using the ν-gap metric to reduce the number of gains in the gain-scheduling set and optimizing the proportional-integral-derivative (PID) values through single-objective optimization. For that, an algorithm was created with all the proposed steps, applying to a Peltier cell and comparing the results with two controllers: gain scheduling adjusted by a classical technique and PI controller adjusted with multi-objective optimization presented in [1]. With the reduced set, two new controllers were created: the first one optimizing a controller for each model in the set separately; the second one optimizing a single controller optimizing the whole set. As a result, it is observed that the separately optimized group is able to control almost as well as the gain scheduling adjusted by a classical technique and the PI controller tuning with multi-objective optimization, but both present a great effort in the control action. With a single controller, the response is slower, but the effort of the control action is significantly better.	BR
2		58	Tarun Tiwari, Nishanth Shastry and Aparajita Nandi. Deep Learning Based Lateral Control System	
			Abstract: Autonomous vehicles have seen advancement in technology over a period of time. Even then, it still lacks robust system for lateral control system of vehicles. Autonomous vehicles are considered future due to increasing population and limited infrastructure. However current trend of industry combined with research in deep learning domain have shown promising results. We tried to demonstrate a lateral control system trained on conventional neural network algorithm. An end-to-end deep neural network is discussed in this paper. Trained model of proposed network is re-implementation of existing model AlexNet and PilotNet. Complexity and size of novel network is much less than existing models. The model has been tested on a virtual environment trained on a small dataset collected from simulated environment. Despite small dataset, model attained accuracy of 97.42% on known tracks and an accuracy of 86.09% on unknown tracks. The result indicates behavioral cloning and reinforcement learning can be used for driving vehicles in unknown environment.	IN
3		80	Ernesto Estremera Toledo, Irina Bausa Ortiz, Ania Lussón Cervantes and Reinel Beltrán Aguedo. Study of time delay compensation in multivariable systems with uncertainties: FSP/MPC	
			Abstract: A study on time delay compensation in systems with uncertainties in the model is presented. For this purpose, two control techniques are used, Filtered Smith Predictor and Predictive Control. The performance of strategies for changes in reference and rejection of disturbances is shown in two multivariable academic case studies with uncertainties, using simulation with Matlab. Through the evaluation of the performance indexes and the temporal response specifications, the robustness of these techniques is confirmed.	ES, BR
4		83	Alejandro Rojas. Signal-to-Noise Ratio Feedback Constraint for Non-Zero Mean Noise Processes	
			Abstract: In this work we consider the closed-loop control of a single-input single-output (SISO) unstable linear time invariant (LTI) plant model over an additive non-zero mean white noise (AWN) channel located either over the feedback path (between the controller and the plant model) or the control path (between the controller and the plant model). We study the stability of the resulting closed-loop in terms of the channel Signal-to-Noise Ratio (SNR) feedback constraint. We then consider a non-zero mean AWN channel with the added effect of a non-zero mean setpoint signal process entering the feedback loop.	CL

Track T2: AUTOMATIC CONTROL (Theory)

	Tuesday	23	Track T23 Chair: Francisco Ibañez	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	15:45	103	René Galindo Orozco. Strong stability for multivariable LTI systems	
			Abstract: In a proposed Observer-Controller Feedback Configuration (OCFC), a class of proper multivariable causal Linear Time-Invariant (LTI) square systems with a detectable and stabilizable realization, is considered. This configuration is based on pseudo-inverses of the input and output matrices, as well as linear robust pre-compensator K1(s) and dual post-compensator K2(s) stabilizing a full actuation full information plant. K1(s) and K2(s) are low-complexity controllers that belong to the Family of All Stabilizing Controllers (FASC) and their free control parameters are selected to achieve strong stability. The separation principle is fulfilled, and necessary and sufficient stability conditions are provided for the overall system to achieve a stable closed-loop system and stable controller. An algebraic approach is used to find these stability conditions that are useful for the pole placement control problem. A simulation of a mechanical system is used to demonstrate the findings.	IN
2		112	Yaiko Orlando Unufio Torres and René Galindo Orozco. R Optimal Nonlinear Regulation of Euler-Lagrange Dynamic Systems	
			Abstract: In this article a control law is designed for fully actuated dynamic Lagrange systems, that is, systems that have the characteristic that their control input dimension is the same as the dimension of the state variable. Canceling part of the dynamics of the system and using Pontryagin's Theorem, a control law is determined that allows the proposed quadratic criterion to be minimized and that ensures the asymptotic stability of the feedback system in the Lyapunov sense. This control law is implemented for optimal regulation, in one of the well-known problems of optimization of the carriage with the pendulum.	IN
3		156	Cristofer Mellado, Karina Barbosa, Hector Chavéz, Carlos Rodriguez and Hicham El Aiss. Observer Design Method for Discrete-Time LPV Descriptor Systems	
			Abstract: This paper deals with observer design for the class of discrete time-varying descriptor systems. In particular, it is assumed that the dynamical system matrix is a function of timevarying parameters that are not precisely known. For this class of system, a Linear Matrix Inequality (LMI) based approach is proposed to the design of complete state observers. An affine parameter-dependent Lyapunov function is considered in order to ensure the error convergence between the actual and estimated state. A numerical example is presented in order to show the proposed observer performance.	CL
4		172	Marco Gordon, Francisco Vargas and Andrés Peters. Comparison of Two Control Strategies for Platoons with Communication Losses	
			Abstract: This paper presents a comparison between two control strategies for platoons of vehicles using cooperative control strategies, under the pressence of communication losses. We consider an homogeneous multi-agent LTI system comprised of vehicles using a predecessor follower topology and a constant time headway policy. Each agent in the string sends its current position to the immediate follower through a lossy channel modeled as a Bernoulli process. To maintain the speed of a vehicle in the event of communication loss, two control strategies are analyzed. When the data of the predecessor is not available, a first strategy uses the previously received data to estimate the position, while the other protocol uses the previously calculated control law. For both cases, we aim to analyze how the lossy channels affect the string stability and the overall behavior of the platoon. Through simulation results, we present the statistics of the position error and the tracking performance for different probabilities of losses and time headways.	CL

Track T2: AUTOMATIC CONTROL (Theory)

	Tuesday	22	Track T24 Chair: Francisco Ibañez	ROOM 1
#	Hora	Paper ID		Countries
1	17:30	174	Oscar Briones, Alejandro Rojas and Daniel Sbarbaro. Robust design of discrete-time General Predictive PI controller for plant models subject to variable network time delay	
			Abstract: This work shows the advantages of the proposed General Predictive Proportional Integrative (GPPI) controller, quantified by integrated absolute error (IAE), compared to the PPI and PI controllers, established with the same robustness using the $ M_s $ criterion in discrete time. The controllers are applied to four plants in simulation on a network control system (NCS), three of the plants are FOPTD plants with different self-regulation indices and one corresponds to a higher order non-minimum phase plant. The tests carried out considered fixed and variable delays in a known range for the communication network. The design of the controllers considers a certain degree of robustness using a strategy based on the Nyquist criterion in discrete time.	CL
2		179	Jackson G. Ernesto, Eugênio B. Castelan, Geovana F. Dos Santos and Eduardo Camponogara. Incremental output feedback design approach for discrete-time parameter-varying systems with amplitude and rate control constraints	
			Abstract: In this work, we investigate an incremental stabilizing Output Feedback (OF) control law for linear discrete-time parameter-varying systems subject to state constraints, control amplitude limits, and bounds of the control-rate variation. To this end, we consider the Positive-Invariance and Contractivity properties of polyhedral sets to guarantee the regional closed-loop stability and that the constraints are all respected. Thus, by using the known necessary and sufficient algebraic conditions for positive-invariance and contractivity of polyhedral sets for LPV systems, we propose a new bilinear optimization problem to deal with the associated constrained control problem. The considered objective function optimizes the size of the associated polyhedral set in given directions, and an efficient non-linear optimization solver is used to tackle the present bilinearities. Numerical examples showcase the effectiveness and potential of our proposal.	CL

Track T3: AUTOMATIC CONTROL (Applications)

	Wennesday	23	Track T31 Chair:Ricardo Pérez	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	16:30	180	Geovana Santos, Eugenio Castelan and Jackson Ernesto. PI-controller design for constrained linear systemsusing positive invariance and bilinear programming	
			Abstract: We address the step-reference tracking for monovariable systems subject to state and control constraints via a PI-control law with a feedforward term. By using invariance and contractivity properties of polyhedral sets, we determine amplitude limits for the step reference that guarantee the regional closed-loop stability and constraints fulfillment, such that the Internal Model Principle remains valid in the polyhedral region. The first main result is based on the positive-invariance property applied to an extended state-space representation that takes the reference model into account, leading to more complex conditions than the ones based on the Δ-invariance property. Based on these two complementary results, a set of bilinear programming problems is proposed to find solutions for the associated constrained tracking problem. and validity. A example illustrates the proposal.	BR
2		186	Jorge A. Zolorza, Jonathan M. Palma and Karina A. Barbosa. $\mathcal{H}_{\infty}$~Gain-Scheduled Algorithm Design for Multi Coupled Tank	
			Abstract: This work deals with the four connected tanks' control and modeling with multiple operation points formulated as a lineal parameter variant (LPV) system. The first step is modeling the plant as a non-linear system and then using its linearization to develop an LPV system based on multiple operation points. Next, knowing the parameters' bounds, an $\mathcal{H}_{\infty}$ robust and an $\mathcal{H}_{\infty}$ gain-scheduling control is designed to the LPV model in order to minimize the perturbation effect in the system output. A numerical example based on a real academic plant is presented to show the effectiveness.	CL
3		17	Cristian Ahumada, Hector Kaschel and Roman Osorio Comparan. Design of an Array of a 2x1 Microstrip Antenna in the WIMAX Band, 3.5 GHz	
			Abstract: This paper presents a design of an Array of a 2x1 Microstrip Antenna in the WIMAX band. The antenna is designed over the operating frequency is 3.5 GHz using the substrate material as Rogers RO3035. The designed antenna can be used for ISM (industrial, scientific and medical) band applications in Wireless Body Area Networks (WBAN). Different performance parameters of the antenna such as operating frequency, Return Loss, Voltage Standing Wave Ratio (VSWR), directivity, SAR have been analyzed both in planar conditions on the human tissue model by using CST Microwave Studio. Finally, Specific Absorption Rate (SAR) is evaluated to satisfy the antenna safety concern on the human body.	CL, MX
4		18	Hector Kaschel, Cristian Ahumada and Roman Osorio-Comparan. Comparison of Two Types of Antenna in the 2.45 GHz Band to Calculate the SAR	
			Abstract: This paper presents a Comparison of Two Types of Antenna in the 2.45 GHz Band to calculate the SAR applied a WBAN (Wireless Body Area Network). The microstrip antenna and half-wave dipole antenna are widely used wireless applications. The designed antenna can be used for ISM (industrial, scientific and medical) band and UWB applications. The designed antennas has low profile, low cost, easy fabrication and Good isolation. The antennas area designed by using CST simulation software and designed antenna provides return loss less then - 10 dB. SAR values are calculated over 1 gm and 10 gm mass tissues. The proposed antennas are	CN, CL, MX

			designed with the purpose of obtaining a low SAR models of the human body, considering both the electromagnetic effect and the shell model in human tissues.	

PROGRAM BY TRACKS

IEEE IFAC ICA ACCA 2021

Track T3: AUTOMATIC CONTROL (Applications), cont.

	Thursday	24	Track T32 Chair: Daniel Sbarbaro	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	14:00	19	Hector Kaschel and Alvaro Díaz. High Security Ubiquitous H-IoT on a WBAN based EHR using Blockchain	
			Abstract: The impact of the Internet of Things (IoT) on the advancement of the healthcare industry in recent times has been significant. The introduction of Medicine 4.0 has resulted in a greater effort to develop platforms, both at the hardware level and at the underlying software level. This vision has led to the development of systems applied to Healthcare IoT (H-IoT). Emerging technologies include communication systems between sensor nodes that allow measurement of physiological variables through the use of WBAN (Wireless Body Area Network); and the processing algorithms to generate an output from the data collected by the sensors. However, these enabling technologies are also supported by several new technologies today, such as the use of blockchain. In this paper we present the main concepts and requirements necessary to design a High Security Ubiquitous H-IoT on a WBAN-based EHR using Blockchain. The advantages of implementing a system of this nature in the short or medium term will allow the countries of the world to greatly alleviate the burden on public health institutions, reducing health costs and increasing the quality of life of people.	CL
2		20	Hector Kaschel and Alvaro Díaz. High Security Ubiquitous H-IoT Monitoring System based on a WBAN	
			Abstract: Wireless Body Area Networks (WBANs) based on the Internet of Things (IoT) play an important role in modern medical systems for monitoring patient health. WBANs have the ab ility to collect real-time biological information from the body of patients using smart sensors and then send the collected information to a ubiquitous, high-security H-IoT monitoring system to effect early detection of patient disease. The advantages of H-IoT are numerous and can greatly ease the burden on public health institutions. In this paper we present the concepts of electronic health records and internet of medical things (H-IoT) and the requirements needed to design a highly secure ubiquitous H-IoT monitoring system based on a WBAN.	CL
3		21	Hector Kaschel and Felipe Paez. Towards a Robust Computer Security Layer for the LIN Bus	
			Abstract: The increasing local and remote wireless connection possibilities available to common vehicles (such as cellular, Bluetooth, V2X communication) have raised significant cybersecurity concerns. This paper presents an up-to-date compilation about security vulnerabilities present in the most relevant in-vehicle communication buses (CAN, LIN, FlexRay), and a summary of various cybersecurity proposals for CAN and FlexRay, from various authors. Possible cyberattacks on the LIN bus are presented in detail, in order to outline the design of a robust IT security layer for this bus, thereby significantly contributing to the safety of vehicle occupants.	CL
4		31	Werbet Luiz Almeida Da Silva, Andrés Ortiz Salazar, Paulo Victor Fernandes Vieira, Maxwell Cavalcante Jácome and Elmer Rolando Llanos Villarreal. Radial Position Control of a Bearingless Machine with Active Disturbance Rejection Control Fuzzy an approach	
			Abstract: A new approach fuzzy active-disturbance rejection position controller of the bearingless induction machine (BIM) servo system is presented in this paper. This work investigates the application of the Active Disturbance Rejection Control (ADRC) Fuzzy technique on the stabilization and control of the rotor radial position of a bearingless induction machine with split winding. A control model for the radial position problem is proposed, and the ADRC-Fuzzy is used, aiming to improve the closed-loop system dynamic when a changing load occurs on the output. The simulations showed that the controller could stabilize the plant and reject disturbances. These results will guide a future experimental validation of the problem.controller could stabilize the plant and reject disturbances. These results will guide a future experimental validation of the problem.	BR

PROGRAM BY TRACKS

IEEE IFAC ICA ACCA 2021

Track T3: AUTOMATIC CONTROL (Applications), cont.

	Thursday	24	Track T33 Chair: Daniel Sbarbaro	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	15:45	44	Amirreza Kosari and Masoud Mirzaei Teshnizi. Multi-Phase Optimal Path Planning and Conflict Resolution of Aircraft in the Presence of Moving and Static Obstacles	
			Abstract: This paper presents an operational approach for decentralized agent-based path planning in the presence of static and moving obstacles. Multiphase path planning consists of the normal mode or the optimal path planning through the static obstacles, the cooperative conflict resolution mode and non-cooperative conflict resolution mode under low flying rules. The normal mode changes if the conflict occurs between two or more aircraft during the flight. It is considered that all aircraft in the conflict zone can communicate with each other. In the conflict resolution modes, the radius of the conflict zone is determined by defining the minimum time of aircraft conflict. To this end, the direct Radau-pseudospectral optimization method was used. The nonlinear point mass equations of motion with the realistic operational constraints were employed for modeling of path planning. The effectiveness of the proposed approach was proved via a case study in minimum time, including cooperative and non-cooperative conflict resolution for the aircraft that must fly in the obstacle-laden environment	IR
2		45	Mehrdad Mirzaei, Amir Reza Kosari and Hossein Maghsoudi. Optimal Path Planning For Two UAVs in a Pursuit-Evasion Game	
			Abstract: The unmanned aerial vehicles (UAV) fly at low altitude in unknown areas in order to avoid being reconnaissance. Here, a path planning technique will be introduced for such UAVs flying at low altitude and playing a pursuit-evasion game. These techniques are based on optimal control and Calculus of variations. In this study, the pursuit-evasion problem of two UAVs-helicopters- which are flying through following the terrain is examined and the optimal trajectories for both robots are obtained. Moreover, it has been sought to use optimal control rules and Differential Games theory to obtain the most favorable path for both UAVs – one as a pursuer and the other as an evader. Since producing the optimal path through solving equations, even in numbers, is a time-consuming trend it is tried to, by designing an artificial neural network in multilayer perceptron networks, locate the position where the evader is captured; hence, choices are made in real times. Consequently, the comparison of neural network results with accurate data obtained previously in the optimal control section confirms the accuracy and performance of the neural network.	IR
3		53	Eduardo Viera, Hector Kaschel and Claudio Valencia. ECG Processing Algorithm in the QRS Complex	
			Abstract: This paper shows an algorithm for the processing of ECG (electrocardiograms) mainly focused on the detection of the "QRS" complex based on the detection of the "R" peaks. The usefulness of this approach is the reduced time window that is used to calculate the speed and acceleration of the heart rhythm, which will allow early detection of arrhythmias and their classifications. For its development, various tests based on simulations and a data logger for three-probe ECG were performed. The results of the tests of this algorithm show with an efficiency of 98% the detection in the changes in the acceleration of the heart rate that they deliver.	CL
4		56	Javier G. Fontanet, Juan I. Yuz, Javier Torres, Marco Gordon and Hector Ramírez. Port-Hamiltonian modeling of the vocal folds using bond-graph representation	
			Abstract: In this work we obtain the bond-graph representation of the vocal folds, to then obtain a port - Hamiltonian model. This model is based on the mechanical elements that represent the folds in the body cover model (BCM). The obtained port - Hamiltonian system is then discretised using truncated Taylor formulation. The parameter and state estimation of this discretised model is then performed using an Extended Kalman Filter and Maximum Likelihood.	CL

	Thursday	24	Track T34 Chair: Ricardo Pérez	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	17:30	76	Gerson Yuri Cagnani Conte, Fellipe Garcia Marques and Claudio Garcia. LQR and PID Control Design for a Pneumatic Diaphragm Valve	
			Abstract: This work demonstrates the design and compares the performance of two different digital control techniques for a modeled pneumatic diaphragm valve. The valve model is derived using first-principles modeling, the Karnopp friction model and approximates the I/P converter dynamics with a first order filter. The digital PID and LQR controllers were chosen to compensate the valve friction. A proposed contribution is to implement a digital LQR control using the Bryson rule and the Pincer technique to tune the matrices Q and R based on requirements response, maximum deviation of states variables and control effort. The robustness of the LQR controller compared to the PID controller is presented in thie papers.	BR
2		87	Arturo Morales and Juan I. Yuz. Reduced order modeling for glottal flow estimation using a Kalman smoother	

			Abstract: The ambulatory monitoring of the vocal folds is a challenging problem that requires accurate modeling of the respiratory system and interaction with the skin for different patients. Bases on these models, filtering or smoothing techniques can be applied in order to estimate the air flow in the folds and its characteristics from measurements of external ambulatory signals. In this work, we apply Kalman smoothing and filtering to estimate the glottal flow from measurements of an accelerometer placed on the neck skin. The model used by the filter is obtained from frequency domain parameter estimation from experimental data obtained in clinical laboratory conditions and model reduction.	CL

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Track T3: AUTOMATIC CONTROL (Applications), cont.

	Friday	26	Track T35 Chair: Ricardo Luna	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	14:00	96	Luis Alberto Casaverde, Redy H. Risco Ramos and Daniel A. Pérez Aguilar. A simulation study of the performance of GPC and PID applied to a binary distillation column	
			Abstract: In this work, the comparison of a control system based on coupled PIDs and a GPC for MIMO systems applied to a Wood and Berry model distillation column has been carried out. The control law has been obtained based on the free and forced responses. Then, the design of independent TITO controls was carried out, using the Simulink/Matlab environment. Likewise, the evaluation of the interactions has been developed by using the relative gain matrix (RGA), to later perform the coupling of the loops with PIDs. Within the study, the behavior in the face of changes in the prediction horizon, changes in the control horizon, and the behavior in the face of changes in lambda and delta weights in the objective function have been analyzed, and additionally, the behavior in the face of disturbances was observed, this to make a comparison between the performance of a PID control (coupled system) and a GPC control. It has been found that the GPC control strategy presents a much better performance concerning the rise time, to the establishment time for the strategy with coupled PIDs. However, the PID still has the advantage of faster tuning due to the tuning tools.	PE
2		99	Maxwell Mineo, Márcio Roberto Covacic and Ruberlei Gaino. Variable Structure Control for a Simplified Linear Model of a Wheelchair	
			Abstract: In this manuscript, a variable structure control strategy is proposed for a simplified linear model which represents a wheelchair commanded by blowing and suction. This model has a proportional and a proportional-integral controller, which were previously included to guarantee stability of the wheelchair. In the simplified model, variations on the parameters of the motors are assumed as polytopic uncertainties, which are considered for the description of the system in state space. Firstly, for a plant A(alpha),B(alpha),C an output feedback matrix G and a constant output tandem matrix F were obtained such that the system A(alpha) B(alpha)GC,B(alpha), FC is strictly positive real. Then, the variable structure control law is designed for the system. The simulation results show the fast convergence of the state variables.	BR
3		102	Jean Carlos Alexander Campos Cercado, José Manrique Silupu and William Ipanaqué Alama. Design and Simulation of a Non-Linear MPC applied to refrigeration system for mango exportation	
			Abstract: This paper presents a nonlinear predictive controller based on state space model applied to a dynamic model with partial equations of refrigeration for mango preservation. Refrigeration systems are widely used in the food industry and are essentially important for the Perú's agro-export sector, the main products in this sector are mango, banana and grape. Advanced control strategies offer the potential to increase the energy efficiency of refrigeration processes while ensuring the quality required for agro-export products. This paper proposes a NMPC designed from a dynamic model based on the fundamentals of thermodynamics and heat transfer of all the elements involved in this system, implemented in a simulated plant from a mathematical model with a switching mode of operation in the evaporator that was previously validated to ensure a similar behavior to a real plant and has been compared with a PID controller to check the control efficiency.	PE
4		106	Elmer Calle and Jose Oliden. Recurrent Neural Network Based Predictive Control Applied to 4 Coupled-tank System	
			Abstract: Model Predictive Control (MPC) is an excellent control strategy that has high performance and a great ability to deal with multivariate process interactions; constraints on both system inputs and states; and real-time optimization requirements. However, some control problem drawbacks such as process non-linearity, or the non-convexity of the resulting optimization problem generate a higher computational cost for real-time MPC implementation, requiring embedded devices with a higher memory and processing capacity. Consequently, MPC is mostly used in processes with large time constants and/or where devices with high computational performance are available. In this article a controller based on a Neural Network trained from the data generated by a suitable MPC is presented. This reduces the computational cost by not requiring to solve the optimization problem online. The proposed controller (RNN-MPC) uses a Recurrent Neural Network to accurately predict the control input based on the previous training data, and once trained the RNN replaces the MPC completely. The effectiveness of the proposed approach is demonstrated through simulations on a multivariate four coupled-tanks system.	PE

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Track T3: AUTOMATIC CONTROL (Applications), cont.

	Friday	25	Track T36 Chair: Ricardo Luna	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	15:45	111	Fabio Silva, Rafael Cosmo, José Leandro Salles and Jussara Fardin. Modelagem de Sistema com Identificação Recursiva Aplicada à Indústria portuária de Minério de Ferro: Um Estudo de Caso	
			Abstract: In iron ore industry, an activity that demands great attention from the operating teams is the collection of pellets from the ore pile and transport to the ship. An equipment known as a bucket wheel reclaimer performs this process. Controlling the flow of ore in the equipment is essential to avoid operational problems, such as clogging, overflow of conveyor belts, stability and integrity of the reclaimer, among others. Currently, the control is carried out by operators through an empirical relationship, which uses the measurement of the electric current of a motor and the reading of a scale, resulting in extremely low efficiency in estimating the flow of ore. Automating this system would be an effective way to mitigate problems and improve operational reliability. In this way, a theoretical model of adaptive automatic control with a recursive identification system is proposed. Recursion is based on the integration of the currently available data (balance and motor current readings) with the available local automation systems, while the adaptive control would act on the equipment's rotation speed. This work is the first part of the development of this theoretical model, being explored the techniques of recursive identification, which were validated with real plant data in MATLAB simulations. Seven estimators were implemented and tested, with some of them showing satisfactory results, with errors (RMSE) of the order of 1E–1 – especially those based on forgetting factor – suggesting that recursive identification is suitable for this application.	BR
2		114	Tania Orrala, Dennis Burgasi, Jacqueline Llanos, and Diego Ortiz-Villalba. Model Predictive Control Strategy for a Combined-Cycle Power-Plant Boiler	
			Abstract: Combined-cycle power plants recycle steam or gas to generate additional power and reduce emissions. In this researchwork, the boiler of a combined-cycle power plant is controlledusing three control strategies, which are designed and compared,for the variables drum water level (□) and superheated steampressure (□□). A conventional PI controller is designed using theLambda-tuning technique to obtain the optimal controller's gains. In addition, a fuzzy logic-based controller that considers the error and the error's rate-of-change is applied. Finally, a model predictive control (MPC) is applied, which objective function is to minimize the steady state error and the variation of the control actions, thus the fuel consumption is reduced. The controllers'performance is compared by analyzing maximum overshoot, settling time, steady-state error, and mainly fossil fuelconsumption, which influences the operating cost. The resultsshow a proper performance of the three control techniques.However, MPC control achieves a higher reduction of fuelconsumption.	EC
3		118	Reinier López Ahuar, Angel L.Cedeño, Ricardo Perez-Ibacache, Juan C. Agüero, and César A. Silva. Comments on the Numerical Efficiency of Constrained MPC of an Inverter with LC Output Filter.	
			Abstract: Two different solvers, quadprog and Operator splitting solver for quadratic programs (OSQP), are used for Modelbased Predictive Control (MPC), and the most efficient option for real-time implementation is presented. It is desired to regulate the output voltage of a Distributed Energy Resources (DERs) LC filter to achieve their behavior as controlled oscillators. The MPC makes it possible to impose constraints at the state and at the input, specifically on the current and modulated voltage at the power converter terminal, but at a high computational cost. Quadprog in Matlab implementation widely used in MPC of slower systems, of the interior point algorithm and OSQP is a newly developed first-order method variant for efficiently solve convex optimization. The use of linear constraints allows the use of efficient quadratic programming (QP) solvers. A state observer is presented to estimate the DER's output current and input disturbances to achieve integration in the control. Matlab/Simulink is used as a control tool and PLECS as electrical simulation software. With this test, simulation is run to estimate the gain in numerical efficiency obtained by OSQP.	CL
4		149	Marco Rivera, Jose Riveros, Consuelo Rodríguez and Patrick Wheeler. Predictive Control Operating at Fixed Switching Frequency of an Induction Machine Fed by a Voltage Source Inverter	
			Abstract: Predictive torque control (PTC) has been established as one of the most popular solutions for variable-speed drives applications, where a quick response of torque and flux is required. The main reason for its adoption is the flexible architecture and good performance attained with this emerging scheme. One of the main issues reported is the variable switching frequency operation. This paper presents a redesigned implementation of PTC to overcome the described drawback. The method is based on the application of two actives plus zeros voltage vectors to produce a constant number of commutation in the inverter legs during every sampling period. The dwell time of the voltage vectors are computed in the optimization process of the predictive control. The validation is performed with simulations, demonstrating the constant switching frequency keeping the high dynamic response of torque and flux.	CL, PY, GB

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Track T3: AUTOMATIC CONTROL (Applications), cont.

	Friday	25	Track T37 Chair: Ricardo Luna	ROOM 1
#	Hora	Paper ID	Authors, title	Countries
1	17:30	150	Antonio Rienzo, Valentina Soza, Miguel Bustamante and Gastón Lefranc. Analysis of Kinesiological Rehabilitation Technologies in patients with Stroke Vascular.	
			Abstract: The cerebrovascular accident (CVA) is the second cause of death and the third cause of disability in the world. A large proportion of adults who survive a stroke can recover; however, this is achieved after going through a long process of kinesiology rehabilitation. Today, there are numerous advances in medical equipment, systems and applications that allow a progressive recovery from the consequences caused by these types of accidents. And that are important for the biomedical engineer who will directly or indirectly work in the rehabilitation of people. The purpose of this work is to analyze the state of the art in which kinesiological rehabilitation technologies are found, through a systematic literature review.	CL
2		167	Enrique Paiva, Jorge Rodas, Yassine Kali, Fernando Lesme, Jose Luis Lesme and Jose Rodríguez Piñeiro. A Review of UAVs Topologies and Control Techniques	
			Various unmanned aerial vehicles (UAVs) have recently emerged and deployed in several real-life applications. The complexity of the coupled and underactuated dynamics and the presence of uncertainties and disturbances have shaped several research projects. Indeed, numerous intelligent and robust linear and nonlinear flight controllers have been investigated in the literature. In this paper, the evolution over the years of UAVs is presented and, a classification is proposed based on different parameters, as well as the advantages and disadvantages of each type. Finally, several applied control algorithms to the UAVs are investigated where a brief explanation is given. The contribution of this work is to give an orientation to the flight control researcher on UAV's nonlinear control.	PY, CA, CN
3		184	Hugo Garces, Eduardo Espinosa, Alejandro Rojas and Gonzalo Carvajal. Modeling optical variables in combustion processes by Hammerstein-Wiener systems	
			Abstract: Control of combustion processes based on optical variables can increase efficiency and reduce contaminant emissions in many industrial settings. Nowadays, the most widely used optical variables, such as total radiation Rad_t or flame temperature T_f is for combustion diagnostics. This paper advances toward a model-based control solution by finding a suitable structure for modeling the dynamic behavior of these optical variables. Evaluations using Akaike's Information Criterion and accuracy over field measurements show that Hammerstein and Wiener structures can accurately model both total radiation in a ladle furnace preheater and flame temperature in a coal boiler, testing SISO and TISO scenarios.	CL

	Friday	25	Track T38 Chair: Ricardo Pérez	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	17:30	187	Mario G. Borja Borja, Sergio Lescano, Jaime E. Luyo and Ubaldo Yancachajlla Tito. MPPT of Three-Phase Self-Excited Induction Generator During Electric Power Generation From Variable Power Sources	
			Abstract: Generate electricity from a variable mechanical energy source as wind deals with methods to track the maximum extration power point of the generator since they can operate under a wide randon speed range. This paper presents a novel control strategy of an three-phase self-excited induction generator (SEIG) in order to get the maximum active power that this generator is capable to provide. This proposition of maximum power point tracking (MPPT) is based on Perturbation and Observation (P&O) method at different speeds of the rotor. Thus MPPT uses slip as perturbed variable and active power as observed variable. Finally, analysis of rigorous simulations is presented, showing the behavior of the generator system with various speed values applied to the generator rotor in a wide working range, verifing its feasibility and validity	PE, FR
2		189	Carlos Rodríguez, Matías Malhue, Matías Díaz, Enrique Espina and Félix Rojas. A Droop Based Control Strategy for Bidirectional Power Regulation in Hybrid AC/DC Microgrids	
			Abstract: Hybrid Alternating Current (AC) and Direct Current (DC) microgrids have been in the spotlight in the last years because they allow connection of AC and DC resources and reduces multiple power conversion in single AC or DC microgrids. The AC and DC stages are connected through interlinking converters, which manage the power transference among both sub-microgrids using droop control strategies for each single AC or DC microgrid. This paper proposes a three-stage droop control strategy to regulate the power inside the sub-microgrids at the same time that bidirectional AC-DC power transference is enabled. Simulation results obtained with a hybrid microgrid model.	CL
3		194	Juan Diego Feijoo, Dario Chanchay, Jacqueline Llanos and Diego Ortiz. Advanced Controllers for Level and Temperature Process Applied to Virtual Festo MPS® PA Workstation	
			Abstract: In this research work, three advanced control algorithms are designed, implemented, and compared to control level and temperature processes in a virtualized Festo Modular Production System of Automatic Processes (MPS® PA) workstation, with an educational focus. A traditional PID control strategy is designed using the lambda tuning technique for each variable,	EC

			the second controller designed is a fuzzy PD controller with integral action at the output and finally, a Model Predictive Control (MPC) algorithm is designed. These three controllers have as objectives, to minimize the error in steady-state and reduce the sudden actions of control, the three control strategies are compared and the maximum overshoot, error in steady-state and settling time are evaluated as performance indicators, moreover, the actuator performance is analyzed. The design of the Festo MPS® PA virtual workstation is also part of this research work.	

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Track T4: ENERGY

	Monday	22	Track T41 Chair: Carolina Lagos	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	16:30	8	Reem Y. Abdelghany, Salah Kamel, Abdelhady Ramadan, Hamdy M. Sultan and Claudia Rahmann. Solar Cell Parameter Estimation Using School-Based Optimization Algorithm	
			Abstract: Recently, great challenges emerged in the field of using renewable energy sources, and one of the most important of these challenges is the use of solar energy, so many researches have been done to show the behavior of solar photovoltaic (PV) cells through the current-voltage characteristic (I-V), which depends on the parameters of the circuit model. Therefore, the importance of extraction of the cell model parameters is necessary for conducting studies of controlling solar PV systems. The main objective of this article is to identify solar cell parameters using school-based optimization (SBO) algorithm. By comparing the results obtained by the SBO algorithm with those obtained by other previously published algorithms, the effectiveness and accuracy of SBO have been proved. The proposed parameter estimation algorithm is applied for each of the two mathematical models (single-diode and double-diode) of the solar cell. The accuracy of the proposed algorithm was checked through current-voltage (I–V) and power-voltage (P-V) characteristics regarding the corresponding measured ones.	EG, CL
2		9	Hoda Abd El-Sattar, Hamdy M. Sultan, Salah Kamel, Ahmed S. Menesy and Claudia Rahmann. Optimal Design of Hybrid Stand-alone Microgrids Using Tunicate Swarm Algorithm	
			Abstract: This paper presents a novel methodology for optimal configuration of grid-independent hybrid microgrids, while using battery storage system and diesel generator as a backup power supply. The proposed methodology highlights the application of a novel metaheuristic optimization algorithm, called Tunicate Swarm Algorithm (TSA) for optimal design of the proposed microgrid. A case study is carried out in an oasis located in the southwest of Egypt for a hybrid system consists of photovoltaic (PV) panels, wind turbines (WT), battery storage, and diesel generator. The main target of the proposed methodology is to obtain the optimal installed capacities of the microgrid components while ensuring the minimum cost of energy and satisfying a high reliability of the power supply. The obtained results proved that the proposed hybrid microgrid system is a profitable solution for electrification in this region.	EG, CL
3		10	Ashraf Ramadan, Mohamed Ebeed, Salah Kamel and Claudia Rahmann. Optimal Allocation of Solar-Wind based DG Considering Uncertainty Using an Improved Grasshopper Algorithm	
			Abstract: Grasshopper optimization algorithm (GOA) is an efficient technique which mimics the movement orientation and lifestyle of grasshopper in natural. However, The GOA is applied for solve successfully numerous optimizations problem, it failed to solve other cases efficiently and it prone to stuck in local optima. Thus, an improved version of the GOA is proposed to enhance the performance the conventional GOA. The improved GOA (IGOA) is based on improving the exploration and the exploitation process of the GOA. The exploration is enhanced using a mutation operators to enable the algorithm to a new area to avoid the stagnation of this technique while the exploitation process is enhanced using an adaptive operator to update the positions of the grasshopper around the best so far solution. In this paper, IGOA is applied to address the allocation problem of renewable energy resources in radial distribution grid (RDG). The renewable resources include hybrid solar wind based Distributed Generator (DG) units for the expected power loss minimization to consider the uncertainty in the electric system. the proposed IGOA is tested on 85-bus distribution grid and the captured results are compared with the traditional GOA to verify its applicability and efficiency. Numerous scenarios are generated using Monte-Carlo simulation to take into consideration the uncertainties of system which include load demands, solar irradiation, and wind speed variations. The simulation results demonstrate that the proposed algorithm is superior for address the allocation problem of DG compared to traditional GOA in terms of objective function.	EG, CL
4		11	Mohammed Abdelhamid, Salah Kamel, Mohamed A. Mohamed and Claudia Rahmann. An Effective Approach for Optimal Coordination of Directional Overcurrent Relays Based on Artificial Ecosystem Optimizer	
			Abstract: In this paper, the artificial ecosystem-based optimization (AEO) algorithm is applied to coordinate directional over current relays (DOCRs). Optimal coordination of DOCRs is non-linear and highly constrained problem but it is important to keep secure and protected power system operation. The AEO algorithm is one of the recent nature-inspired meta-heuristic algorithms. It simulates the flow of energy into an Earth's ecosystem by three living organisms including production, consumption, and decomposition. The AEO is successfully applied to coordinate DOCRs with the aim of minimizing the overall operating time of the relays used in three test systems including 8-bus, 9-bus, and 15-bus systems. The results of the developed algorithm are compared with other well-known algorithms. The simulation results demonstrated the importance and effectiveness of the proposed algorithm in finding the optimal coordination of DOCRs and minimizing the overall operating time of the relays.	EG, CL

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Track T4: ENERGY, cont.

	Tuesday	23	Track T42 Chair: Carolina Lagos	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	14:00	22	Ahmad Eid and Salah Kamel. Optimal Allocation of Multiple Distributed Generations in Radial Distribution Systems using Levy Flight Distribution Algorithm	
			Abstract: In this work, the newly metaheuristic Levy Flight Distribution (LFD) optimization technique is implemented for optimal allocation of distributed generations (DG) in radial distribution systems (RDS). The integration of DGs elevates the performance of the distribution systems. The improvement of the system performance appears in a reduction of the power losses and voltage deviation and maximizing the stability of the system. Different numbers of DGs operating at unity power factor (UPF) and optimal lagging power factor (OLPF) are used to achieve the various objectives. The IEEE 33-bus RDS is used as the test system. The obtained results verify the value of the LFD algorithm for solving the DG allocation problem.	EG
2		25	Mohammed Kharrich, Omar Hazem Mohammed, Salah Kamel, Mansour Aljohani, Mohammed Akherraz and Mohamed I. Mossad. Optimal Design of Microgrid Using Chimp Optimization Algorithm	
			Abstract: The hybrid power systems become necessary, mainly in non-electrified areas such as Africa, where millions of peoples haven't access to electricity. This study deals with the design problem of the hybrid system, containing PV panels, wind turbines and battery storage system. The paper study focuses also on the application of a recent algorithm named Chimp Optimization Algorithm (ChOA), and compared it with two algorithms called IWO and GWO. The hybrid system design is based on optimizing the net present cost function, respecting some constraints. The results showed that the recent ChOA algorithm is better than the IWO and GWO both, however, the system is very suitable in the Dakhla location, where the metrological conditions are suitable.	MA, IQ, EG, SA
3		26	Najib M. Alfakih, Ahmed S. Menesy, Ping Wang, Mahmoud A. Ali, Hamdy M. Sultan, Mohamed I. Mossad and Salah Kamel. Efficiency Improvement of Solar Cells by Coating with Chlorophyll and Different Types of Oils	
			Abstract: In this paper, two techniques are developed and used to experimentally improve the solar cells efficiency by coating the outer surface of the panels with oil and chlorophyll. Coating the outer glass of solar cell with small layer of oil improves the value of sunlight absorbed by panel and accordingly the efficiency of the panels dramatically increases due to high transmissivity of some types of oils, especially vacuum oils. In this experiment, four types of oils are examined such as vacuum oil, engine oil, abro oil used as a mineral oils and sunflower oil examined as a natural oil. During the experiment, it has been observed the efficiency of the solar cell panels that have been coated with vacuum oil (labovac oil) increased by 11.28% compared to the efficiency of the same panel before coating. Similarly, coating the outer surface of solar panel with 1.5 mm layer of chlorophyll improves the efficiency by 4.17% as chlorophyll absorb a wide range of sunlight falling on surface of the photovoltaic panel and thus increase its efficiency.	CN, IQ, EG, SA
4		27	Ahmed Rashad, Mohamed Ebeed, Salah Kamel and Mohamed I. Mossad. Performance Enhancing PV System Interconnected with D-STATCOM Using ANN and LAPO	
			Abstract: Due to the large presence of solar power plant in electric power networks, it became obligatory to study the interaction between them and the associated networks. In this paper, a Distribution Static Synchronous Compensator (D-STATCOM) is used to improve the performance of a photovoltaic generation plant (PV) during three phase fault of interconnected grid. Artificial neural networks (ANN) based on Lightning attachment procedure optimization (LAPO) is used to tune the control parameters of D-STATCOM in targeted with PV plant. The LAPO is used for generating historical data needed for ANN. In order to point out the contribution of this paper the performance of PV system without and with D-SATCOM is compared during three-phase fault and when D-STATCOM is tuned by LAPO only and by proposed ANN.	EG

Track T4: ENERGY, cont.

	Tuesday	23	Track T43 Chair: Karina Barbosa	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	15:45	29	Erik Carreño, Hector Gomez, Edilberto Vásquez, Raul La Madrid and Daniel Marcelo-Aldana. Modeling and mathematical validation of the heat and mass transfer mechanisms in the treatment of fruits and vegetables using the Controlled Instantaneous Decompression method	
			Abstract: The article focuses on rigorously describing and analyzing the dehydration process with regard to fruits and vegetables through the use of controlled instantaneous decompression (DIC) treatment. The mathematical modeling is obtained from the discretization of Fourier's and Fick's laws by the finite difference method. This is applied to the most common geometries in drying processes - the parallelepiped and the flat cylinder geometries. The validity of the mathematical model is determined by the Pearson correlation coefficient, which provides the linear relationship between two quantitative random variables in the form of the data obtained experimentally in the laboratory of La Rochelle University (France), and the results obtained from the mathematical model presented in this article.	PE
2		30	Dawod M. R. Al-Qadasi, Ahmed S. Menesy, Ping Wang, Najib M. Alfakih, Qianjin Zhang and Salah Kamel. Study on Preparation Method of Heat-Insulated Super-Hydrophobic Film and Improvement of Photovoltaic Modules Efficiency	
			Abstract: Dust accumulation effects for the solar panels are adverse factors, which affect the efficiency, output power and current. The humidity increased the dust particles adhesion force on a surface which increased the hardness of removing dust. In this research after coating the PV modules, it has the hydrophobicity on the surface to make self-cleaning and allow more visible light to be transmitted to improve the efficiency of solar panels, which made difference of transmittance for the experimental group and the uncoated module about 7% and archives significant increase for short-circuit current (Isc) about 6%. The maximum output power (Pmax) for experiment E3 is higher than the uncoated PV module by 46.5% and the efficiency also is higher than the uncoated PV module by 48% after self-cleaning of dust. Infrared light is the main effect on the operating temperature for solar panels. In our study the chemical structure of Nano antimony tin oxide (Nano ATO) heat-insulated super hydrophobic films have the characteristics of reflecting infrared light and transmitting visible light to decrease the temperature of PV modules. The gradual changing for mole ratio of Nano ATO in the three experimental group can show gradual difference of transmittance on the three PV modules such as E3, E2 and E1 have transmittance about 83%, 83.6% and 84.9%. And achieved difference temperature of E3 about 7.4 °C with enhancement about 17%, Isc about 6% and Pmax average without dust effects about 14.4% and compared with uncoated film.	CN, EG
3		34	Mohamed Khamies, Gaber Magdy and Salah Kamel. Slime Mould Algorithm for Frequency Controller Design of a Two-area Thermal-PV Power System	
			Abstract: In this study , a new implementation of the slime mould algorithm (SMA) is proposed to find the optimal parameters of proportional-integral (PI) controller of frequency controller of a two-area interconnected power system composing thermal generator unit and photovoltaic (PV) system. Moreover, the design process of the considered power system takes the maximum power point tracking (MPPT) of the PV in its consideration. Furthermore, a time domain based on the integral of time multiply absolute error (ITAE) is established to robust design the parameters of the PI controller utilizing the proposed SMA method. In terms of settling time, maximum overshoot, and maximum undershoot, simulation results show the superiority of the PI controller based on the SMA method than other optimization algorithms.	EG
4		61	Heba Youssef, Mohamed H. Hassan and Salah Kamel. Parameter Estimation of Single Phase Transformer Using Jellyfish Search Optimizer Algorithm	
			Abstract: In this paper, new application of Jellyfish search optimizer algorithm (JS) is proposed to estimate the parameters of single phase power transformer which is one of the engineering problems. JS algorithm simulates the motion jellyfish in the ocean. This study aims to estimate the parameters of equivalent circuit of single-phase transformer by current and voltage values at any different load. Through algorithm, difference between actual data and estimated parameter values, the error, has been tried to reduce. Moreover, experiential verifications are done on 4 kVA, 250/125 V, 50 Hz single-phase transformer.	EG

	Tuesday	23	Track T44 Chair: Karina Barbosa	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	17:30	62	Juan Quiroz, Ismael Soto, Esteban Toledo, Héctor Chávez, Raúl Zamorano-Illanes and Jonathan Pereira-Mendoza. A non-linear regression model for inertia identification using synchrophasors and Big Data	
			Abstract: This work proposes a model for the identification of the inertia of an electrical power system. A non-linear regression is used from a mathematical model that relates power and frequency variation, obtained from a synchrophasor network. Adjustments of the non-linear regressions processed with Big Data, from the PMU and the different real generation contingencies.	CL
2		63	Constanza Arevalo, Eber Ibañez, Jaime Rohten, Rodrigo Morales, José Silva, Nathalie Risso and Vladimir Esparza. MPPT Algorithm for Photovoltaic Arrays Under Partial Shading Conditions	
			Abstract: The importance of renewable energies has brought the attention of many researchers around the globe in different areas of solar power generation, such as building, controlling, power injection, and even recycling. This work studies the effect of partial shading on a solar array, composed by many panels in series and parallel to achieve a given amount of power to inject energy into the grid. The focus of this work is toward the design and implementation of an algorithm capable to find the global maximum power point despite the existence of other local maximum power points (MPPs). The algorithm is based on scanning for the maximum power point around points of state	PE

			space, where it should, if the actual power change as a function of irradiance and temperature. In order to control the voltage at the photovoltaic solar array, a DC-DC boost converter is employed, which is controlled by using the steady state model. Simulated results show the feasibility of the proposal and a fast-dynamic behavior associated to finding the maximum power point, no matter where the global MPP is located	

PROGRAM BY TRACKS

IEEE IFAC ICA ACCA 2021

Track T4: ENERGY, cont.

	Wednesday	24	Track T45 Chair: Karina Barbosa	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	16:30	64	Angel Pineda-Sanchez and Daniel Marcelo-Aldana. Mathematical modeling in a MATLAB environment for a triple effect evaporation system for the non-centrifugal sugar production process	
			Abstract: The aim of this research is to determine the most suitable configuration for an arrangement of closed evaporators that make up an evaporation system fed by the steam from a bagasse boiler as part of the non-centrifuged sugar (jaggery) production process. The aim is also to evaluate the energy saving that can be made by adding closed evaporation stages to the system. This numerical analysis involves the thermodynamic analysis of the evaporation process, including both energy and mass balance for each part of the evaporation system. A parametric analysis is included to determine the nature of the impact of the feed steam pressure and temperature, and the impact of the number of effects on the initial energy requirements. Taking as a model the NCS capacity of the Santa Rosa de Chonta plant, located in the district of Montero, Ayabaca (Peru), the general sizing of the evaporators is carried out. This plant has a production capacity of approximately 90 kg of jaggery (panela)/hour.	PE
2		72	Jorge Varela and Miguel Parada. Simulation and mitigation of subsynchronous resonance in power systems	
			Abstract: This paper presents a detailed time domain simulation of a synchronous generator connected to an infinite bus though a transmission line with series capacitors, for the purpose of analyzing the causes and effects of subsynchronous resonance. To mitigate the serious damage that this phenomenon might cause to the generation unit shafts, a supplementary control of the synchronous generator excitation system, and the NGH damping scheme are analyzed. The effectiveness of these mitigation methods is verified by numerical simulations on MATLAB, based on Runge-Kutta algorithms.	CL
3		77	Jose Alcarazo, Keyla Checa, Cesar Cisneros, Melannie García, Daniel Marcelo-Aldana and James Ordinola. Mathematical Analysis and Numerical Modelling in the Transient State of Heat Transfer from a Solar Dehydrator	
			Abstract: The article focuses on analysing and designing a direct solar banana dehydrator by applying heat transfer concepts using MATLAB as mathematical modelling software. The validation of the mathematical modelling presented here is determined by the Pearson correlation coefficient. This provides the linear relationship between two quantitative random variables, which in this case are the data obtained experimentally in [2] and the results obtained in Forecasting the mathematical model presented in this article.	PE
4		79	Marcio Andrey Roselli, André Luiz Veiga Gimenes and Miguel Edgar Udaeta. Daily Electrical Load Profile to Peak Load Pricing Using Artificial Neural Network	
			Abstract: This paper presents a method of characterizing Load Distribution Networks for peak load pricing, using load profiles sampling from consumer units, commercial distribution database, and climate variables. It is considered rate subgroup, consumer class, and temperature as exogenous variables. The temperature data considered in the model are directly related to load destined for cooling and heating. Modeling is supported by Artificial Neural Networks methodology with Multi-Layer Perceptron architecture and Back-Propagation training algorithm. In a real case study, load profiles in the Brazilian electrical system, for the period from September 2013 to August 2014, are compared with clustering models traditionally used in load profile characterization to peak-load pricing. The model provides a forecast error equivalent to 5.46% in the distribution sector, lower than the forecast error of 23.04% for the clustering model and load typologies.	BR

Track T4: ENERGY, cont.

	Thursday	25	Track T46 Chair: Matías Díaz	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	14:00	84	Darwin Abel Gamero Saavedra, Daniel Marcelo-Aldana and Raul La Madrid Olivares. Design and development of a code in MATLAB environment for the thermodynamic and parametric analysis of non-centrifugal sugar production technologies	
			Abstract: In this work, a code is designed and developed using MATLAB software for thermodynamic and parametric analysis, different technologies for the production of non-centrifuged sugar. Additionally, a methodology is developed to calculate the energy and operation indicators of each of the technologies studied, such as the consumption of bagasse, the temperature in the combustion chamber, etc. With this, a graphical interface (GUI) is developed, which allows the user to enter experimental data and obtain the parameters mentioned above. It is proposed to analyze the influence of some variables on the calculated results, such as temperature, amount of fuel, etc. and finally carry out a comparative analysis of the technologies, to define the best alternative in the production of non-centrifugal sugar	PE
2		88	Sebastian Laca-Cuglievan and Daniel Marcelo-Aldana. Design and energy balance of a bagasse-fired water-tube boiler for non-centrifugal sugar production using steam technology	
			Abstract: The article focuses on rigorously describing, analyzing, and calculating all the stages of the steam generation process by means of a water tube boiler using sugarcane bagasse as fuel. The steam produced will be used for the non-centrifuged sugar production process. The mathematical model is obtained from the law of conservation of energy for open systems in steady-state flow in thermodynamics and the laws of Fourier, Newton, and Stefan-Boltzmann in heat transfer. The Newton-Raphson method is applied to solve non-linear equations. Finally, the variation of fuel moisture and steam production is analyzed in the mass and energy balance. The validity of the mathematical model is determined by comparing the assumed flue gas temperature in the stack (input parameter) with the calculated flue gas temperature at the air heater outlet, which must be equal.	PE
3		95	Pedro Henrique Macedo Nascimento, Vinícius Albuquerque Cabral, Adriana Oliveira Mendonça, Helena Bernardes Sobreira Paixão E Rezende, Ivo Chaves da Silva Junior and André Luiz Marques Marcato. Perdas Técnicas em Redes de Distribuição na Presença de Recursos Energéticos Distribuídos	
			Abstract: The integration of distributed generation (DG) in distribution networks has grown in recent years due to its ability to increase the efficiency of the system. One of the aspects that increase this efficiency provided by GD is the reduction of electrical losses. In this study, simulations of different cases are carried out to assess the losses of active power depending on the location and the level of penetration of distributed photovoltaic generation. The study is divided into two stages. In the first one, the objective is to verify the impact of the GD location on the technical losses of the distribution system. Based on the best location obtained, the technical losses are evaluated in relation to the level of penetration of these sources in the system in the second stage. In the latter, five possible penetration scenarios were considered and the behavior of technical losses in the distribution systems was analyzed. The simulations are performed using OpenDSS software and are applied for the standard IEEE 34-node distribution system. The results demonstrate that the insertion of distributed generation can contribute satisfactorily to the reduction of technical losses in energy distribution systems, as long as they are well allocated and with an optimized penetration level.	BR
4		127	Carlos Martinez, Jaime Rohten, Matias Garbarino, Marcos Andreu, José Silva, Carlos Baier and Rodrigo Morales. Operating Region for AFE Configuration under Variable Frequency Grid	
			Abstract: Distributed power generation together with micro-grids and renewable energy have brought the problem of power generation and electric system stability. These kinds of grids have shown problems related to the frequency and amplitude voltages. In effect, the literature shows variation up to 100% on the grid frequency, leading to carefully design the equipment that is connected to these grids. This paper studies the frequency variation, the sag, and swells effect on power converter by using the two most used topologies, the power converter as rectifier and inverter with their respective first order and second order filters respectively. The results show the large effect on the power converters and therefore demonstrate the importance of considering the frequency on the control design, since the entire operating region is affected	CL

Track T4: ENERGY, cont.

	Thursday	25	Track T47 Chair:	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	15:45	129	Adrián Torres, Jaime Rohten, Miguel Albornoz, Vladimir Esparza, Nathalie Risso and Javier Muñoz. Photovoltaic Technical and Economical Study for Medium and Large Agroindustry	
			Abstract: Renewable energies sources have grown regularly in the last year, because they have been a solution not only for reducing the power expenses but also to be employed in the remote areas and places, moreover, all companies will be obligated to produce or buy clean energy to reach carbon neutral in 2025. Thus, this paper makes the technical and economical analysis of including solar power system in a mayor berries agroindustry. The study includes all considerations the farmers should consider for solar panel installation in order to not only produce for themselves but also sell the surplus to the grid. This is important, since during winter season the irrigation energy requirements is minimal compare with the middle of the summer, and therefore the total amount of produced energy should be sold to the grid in order to improve the investment payback time. The complete analysis is illustrated based on the actual normative and tools to configure solar systems.	CL
2		144	Murilo E. C. Bento. An Improved Direct Method to Compute the Load Margin of Power Systems	
			Abstract: The voltage stability margin consisting of a load margin between the load level of the nominal operating point and the load level where a voltage collapse occurs, a voltage instability, is a valuable safety measure used in operation centers of power systems. However, this load margin may not be adequate because it does not consider oscillatory instabilities that may eventually arise as the load level increases and also because it does not consider different schemes for active power generation redispatches. This article proposes a unified direct method that determines the load margin of power systems considering voltage and oscillatory instabilities and, in addition, different schemes for active power generation redispatch are considered. Case studies of the application of the proposed method in the IEEE 39-bus power system model are presented and discussed.	BR
3		145	Murilo E. C. Bento. Bird Swarm Algorithm Applied to the Wide-Area Damping Controller Design	
			Abstract: Low-frequency oscillation modes, local or inter-areas, when not properly mitigated can compromise the stability of power system operation and consequently the supply of electricity to consumer centers. Traditionally, the use of Power System Stabilizers has been promising in mitigating local oscillation modes but has limited effect in inter-area modes. Recent advances in communication technologies have enabled the creation of Wide-Area Damping Controllers (WADCs) whose input signals are provided by Phasor Measurement Units (PMUs). These WADC is multivariable and thus is more promising in mitigating inter-area oscillation modes. However, variable delays in the transmission of signals on the communication channels can compromise the design. This article proposes a WADC design method based on Bird Swarm Algorithm considering two limits for signal transmission delays: one stipulated for the normal operation of the control system and the other for cases where the time delay exceeded the first limiter for some reason. Case studies are presented in this article including statistical evaluation and nonlinear time-domain simulations.	BR
4		148	Aldo Barrueto, Matías Díaz and Héctor Chávez. An Overview of Challenges related to Power-Electronics Based Power Systems	
			Abstract—The Role of power electronics in the future of power system is becoming critical due to the growth in renewable energy generation and the evolution of technologies such as flexible alternating or direct current transmission systems. Consequently, electrical power systems are facing new challenges related to the reduction of inertia and increment of the requirements in terms of control and flexibility. In this context, this paper aims to facilitate future research in this subject by providing a compact overview of the main challenges of power electronic-based power systems, inertia management, stability and control issues.	CL

Track T4: ENERGY, cont.

	Thursday	25	Track T48 Chair: Mario Fernández	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	17:30	182	Fabian Gutierrez, Esteban Riquelme, Karina Acosta Barbosa and Hector Chavez. State Estimation for Synthetic Inertia Control System Using Kalman Filter	
			Abstract: The growing penetration of wind systems has caused instability in the control of the frequency of power systems. Due to this, multiple control methods have been generated to emulate inertia in wind systems. However, to achieve that, it is necessary to have measurements as exact as possible to carry out the correct control, which is not always feasible. Therefore, state estimation systems and filters are used to obtain unmeasurable states and the approximation and minimize noise or uncertainty. In this article, a Kalman filter design is proposed to the synthetic inertial system, using the LMI formulation. The designed filter allows the states to be estimated with great accuracy, eliminating almost all the observation noise. A numerical example considering different wind speed and power penetration is presented in order to show the efficiency of the proposed approach.	CL
2		183	Álvaro Fernández, Matías Díaz, Félix Rojas, Lorenzo Reyes-Chamorro and Héctor Chávez. Impact of the electrical energy-tariff and Vehicle-to-Grid in the total cost of ownership of electromobility projects	
			Abstract: This paper evaluates the impact of the electric powertariff on the total cost of ownership of electromobility projects, mainly vehicle renewal, comparing the current regulation in Chile with special tariffs applied in other countries. The emphannual equilibrium mileage is proposed, which makes it possible to equalize the value of a renovation project for a combustion vehicle and an electric vehicle. Additionally, regulatory measuresare applied to lower the value of emph annual equilibrium mileage, such as purchase incentives and V2G.	CL

	Friday	26	Track T49 Chair: Cristián Durán	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	14:00	188	Melannie Sepúlveda, Esteban Baeza, Mauricio Carrillo, Nathalie Risso and Jaime Rohten. Hydrogen technologies and PEM fuel cells: A sustainable alternative for Chile	
			Abstract: Severe climate change effects along with the increasing need for countries to become independent from fossil fuels are leading countries to seek more sustainable energy sources. This is not an easy task, as many renewables lack the portability and reduced variability which is required to properly satisfy energy demands. In this context, Hydrogen technologies are a promising alternative to work towards this goal. This work presents a brief summary on Hydrogen technology properties, focusing in particular on the description of Hydrogen cells, their characteristics and main applications. Finally, the operation of a PEM cell is simulated using a computer model, in order to illustrate how these tools can be used to further characterize PEM cell performance when designing hydrogen-based solutions.	CL
2		190	Abraham Pastor, Nathalie Risso, Jaime Rohten and Fabricio Salgado. Wind Turbine Pitch Predictive Control for Smoothing Power generation	
			Abstract: Wind energy gains interest due to the diversification and decarbonization of the energy matrix to leave behind the use of fossil fuels that contribute to global warming. Obtaining energy from the wind is complex, since wind energy has a variability that strongly affects the quality of the energy generated, in addition, the wind turbine has non-linear characteristics that make the control stage even more difficult. Various techniques address this issue, and acclimatization is required. This work presents the pitch control design methodology for a large capacity wind turbine. Linearized dynamics and MPC controller are used to manage the pitch angle of the wind turbine. The results are validated with real data from southern Chile and show acceptable results for power smoothing.	CL
3		192	Nicolas Retamales and Hector Chavez. Frequency-responsive Appliances: The case of Chile	
			Abstract: The growing concerns on the deterioration of frequency control and inertia levels due to renewable integration has lead to an increasing interest in new ways to improve the frequency response of power systems. In such a scenario, demand response from house appliances has been proposed for as a contribution in this sense. This work presents an study on the impact of the integration of frequency-responsive fridges on the Chilean Power System. A simulation is provided to show numerical results.	CL
4		197	Guillermo Gajardo, Adan Hansen, Denis Riquelme and Pedro Melin. A technical study toward the implementation of an experimental microgrid in Universidad del Bío-Bío	
			Abstract: This works proposes a new configuration for an electrical grid in Universidad del Bío-Bío, aimed to implement an experimental microgrid for research of power quality applications and educational purposes. The proposal is theoretical based on the technical reports of microgrids worldwide to have a global vision of loads and technologies used in this kind of electrical grids. Then and focusing the Gantes Building as the location for the experimental microgrid implementation, the building grid and its loads are studied, including the Electrical Machines Laboratory to emulate industrial loads. With the above, the reconfiguration of the electrical network and new equipment to implement the microgrid are propose, showing that it is possible the implementation of the experimental microgrid in a three-phase 380V 50 Hz grid.	CL

Track T4: ENERGY, cont.

	Friday	26	Track T410 Chair: Cristián Durán	ROOM 2
#	Hora	Paper ID	Authors, title	Countries
1	15:45	201	Allyfrahy Nunes Alves, Paulo Peixoto Praça, Demercil de Sousa Oliveira. Jr and Luiz Henrique Silva Colado Barreto. 1KW Amplifier Class D Design with GaN Switches	
			Abstract: With recent advances in Gallium Nitride (GaN) semiconductor technology, it is possible to achieve greater applications in the power electronics market, allowing high switching speeds and high power conversion densities by transistors. This work presents application of GaN transistors in the development of class D audio amplifier of 1KWrms in order to observe efficiency and losses generated in the switches, using complete bridge topology with unipolar modulation and proportional control integrative derivative (PID) digital.	BR
2		158	Marco Rivera and Patrick Wheeler. An Overview of Solar Energy in Chile	
			Abstract: This paper shows the installed power capacity in electrical systems of conventional and non-conventional renewable energy found in the country, as well as the evolution of the photovoltaic solar capacity installed from 2015 to the present and the percentage distribution of Non-Conventional Renewable Energies (NCRE). The ten most important solar plants whose capacity ranges from 101 MW to 196 MW, located in the north of the country will be presented, along with the approved or in classification projects under construction, which together will represent an increase of the energy matrix in 6625 MW.	CL

PROGRAM BY TRACKS

Track T5: POWER ELECTRONICS

	Monday	22	Track T51 Chair: Cristián Durán	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	16:30	16	Yesenia Murga, Christian Rojas, Samir Kouro and Nicolas Muller Modelling of Non-Isolated Photovoltaic Energy Power Source for 3U NanoSats	
			Abstract: In this work, the modelling of a non-isolated Photovoltaic (PV) Energy Power Source (EPS) for a 3U CubeSat miniaturized satellite is presented. The power source is composed by two PV arrays with multiple DC-DC converters, responsible for the control of electrical variables in the power unit. Maximum power extraction from solar panels and charge/discharge of a battery pack are tested based on dynamic profiles proposed in the context of IFEC 2020 [1]. Finally, each modular unit is simulated in order to validate the proper operation of power source.	CL
2		28	Yousry Ibrahim, Ahmed Rashad, Salah Kamel and Mohamed I. Mossad. Performance of PMSG-Wind Power Plant During Three Phase Faults with ANN Based Control of STATCOM	
			Abstract: Recently, much reliance has been placed on renewable energy sources. Wind energy is one of the most important of these sources as wind is used to produce electricity. In this paper, the Permanent Magnet Synchronous Generator (PMSG) with wind turbines is used to produce electricity. Most of the time, wind farms are connected to the electrical grid directly which affects the performance of the electrical network. The Distribution Static Compensator (D-STATCOM) is employed to improve the performance of power systems. This paper applies the artificial neural networks (ANN) to evaluate the best values of control gains of D-STATCOM to enhance the performance of the PMSG during three phase faults. The performance of PMSG with ANN- D-STATCOM is compared with the performance of PMSG with Lightning attachment procedure optimization (LAPO) tuned D-STATCOM and the performance of PMSG without D-STATCOM	EG
3		54	Diego Soto Sanchez, Luis Reyes and Roberto Cardenas. A Hybrid MMC-based induction motor drive with no torque restrictions at low speeds	
			Abstract: The adjustment of the DC-link voltage in proportion to the speed, except at very-low frequencies, can potentially overcome torque limitations in MMC-based AC motor drives. However, the grid- and motor-side converter require be equipped with FB cells. To reduce this requirement, this work proposes the use of Hybrid MMC converters. To further improve performance at very-low frequencies, it is proposed that the intermediate link, between the grid- and motor-side converter, be operated as AC link, instead of DC-link, but only at low speed. An AC link voltage having a relatively small amplitude and frequency, compared to nominal values of the motor, is sufficient to maintain the ripple as low as that of the nominal speed.	CL
4		59	Duberney Murillo-Yarce, Marco Rivera, Carlos Restrepo, Javier Muñoz, Carlos Baier, Raúl Rodríguez, Patrick Wheeler, Pericle Zanchetta and Galina Mirzaeva. Common-Mode Voltage Reduction in a VSI Inverter Applying Sequential Predictive Control	
			Abstract: In the classical predictive control (CPC) implementation a cost function designed in terms of the control objectives and constants known as weighting factors must be minimized. Weighting factors are usually obtained by trial and error since there is no methodology to find the best factors, which also improve the controller performance. One possible solution is sequential predictive control (SPC) that proposes to eliminate weighting factors by sequential evaluation of simple cost functions. The contribution of this work is to analyze in detail the SPC performance and compare the results with a classic predictive current controller, in a VSI converter feeding an RL load where common-mode voltage is also reduced.	CL, CO, GB, AU

Track T5: POWER ELECTRONICS, cont.

	Tuesday	23	Track T52 Chair: Karina Barbosa	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	14:00	75	Álvaro Palma, Jesus Moreno, Jorge Palma, Rocio Domínguez, Jaime Rohten and Vladimir Esparza. Comprehensive Review of Torque and Vectoring Control for Electrical Powertrains	
			Abstract: In the last few years, a rise in the planet earth pollution has brought forward a necesity for renewable energies and different ways to exploit them in order to replace the coal, oil and gas. In this context, the entire world is looking forward to produce electricity by the means of -mainly- solar and wind energy, but also searching for other clean alternatives. This electricity may be used to transport people into and out of the cities, helping to reduce pollution gases that every day saturates big towns. In fact, it is expected for electromobility to be the most important way to transport people by 2050, and therefore, the design and development of proper control algorithms for electric machines become imperative in order to improve driving and safety in modern powertrains. This paper studies and reviews some of the most important works, with a special mention about, regenerative braking, grip improvement, and vectorial torque control considering the entire car dynamics. As results, this document shows the importance of the proper control of powertrains to make cars even more flexible and robust than traditional combustion ones	CL
2		89	Dhanasekar R, Chitra Manis Raja M, Vijayaraja Loganathan, Marco Rivera and Ganesh Kumar Srinivasan. Design of Higher Order Converter for Piezo Electric Energy Harvesting Applications	
			Abstract: Conditioning the output voltage of Piezo-electric crystal is very important for Energy harvesting process. The efficient way to harvest the energy from the system mostly depends on its interfacing circuitry. It is necessary to characterize and optimize the interfacing circuit for maximizing the output power. The circuit parameters such as duty cycle, switching frequency, inductance and load resistance have been characterized and optimized to improve the efficiency of the harvesting system. A higher order Cuk Converter is proposed for integrating piezoelectric energy harvester (PEH) and energy storage elements or load directly. The circuit has been simulated using Matlab Simulink. The input voltage of the piezoelectric transducer is an impulse force and the rated output voltage has been obtained as 1.3V from a single crystal (PZT-5A) and a total of 5.2V is obtained by cascading five crystals. The output voltage of the crystal stack is rectified and boosted using Cuk converter. The operating range of the system is increased by employing PI controller, Sliding mode controller and Hysteresis controller.	IN, CL
3		90	Vijayaraja Loganathan, Nandhinipriya V, Dhanasekar Ravikumar, Ganesh Kumar Srinivasan and Marco Rivera. Simulation and Experimentation of 57 Level Inverter	
			Abstract: In this paper, a 57 level asymmetric multilevel inverter is proposed with less number of devices and sources. Working process of symmetric and asymmetric structures are studied and tested using MATLAB. Proposed asymmetric structure is compared and analyzed against other multilevel inverter topologies. Resistive load and reactive load is considered for symmetric and asymmetric inverter simulation. Further, symmetric and asymmetric configurations are compared in terms of harmonic content. Proto-type development is carried out for the fifty-seven level asymmetric inverter and the test results are presented. From the results, it is concluded that both symmetric and asymmetric structure yield low harmonic output waveforms.	IN, CL
4		101	Oscar Nuñez-Mata, Fauricio Acuña-Rojas, Cesar Gonzalez-Solis and Gustavo Gomez-Ramirez. Assessment of Power Transformers using a Methodology Based on Health Indices	
			Abstract: The development of a proper monitoring condition of power transformers is essential for the secure and reliable operation of electric power systems. In a power transformer, the health condition is influenced by multiple factors including chemical, electrical and mechanical stresses. Therefore, it will be necessary to propose new tools to evaluate the health condition of power transformers. This paper proposes a health index (HI) to assessment the condition of power transformers. The HI is divided into two sub-indices, which determine the overall index using a series of off-line tests frequently performed. Firstly, a functional sub-index is proposed, which involves general electrical tests, such as winding resistance, transformation ratio and excitation current, as well as dissolved gas analysis. Secondly, a dielectric sub-index based on the oil tests and the power factor test. Finally, the overall HI is calculated by weighing both subindexes. The proposed methodology was evaluated using a data base containing field diagnostic tests collected from the year 2014 to 2019. The values obtained for the HI were contrasted with the records of each transformer evaluated to evaluate the effectiveness of the proposed methodology.	CR

Track T5: POWER ELECTRONICS, cont..

	Tuesday	23	Track T53 Chair: Marco Rivera	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	15:45	104	Johan Guzman, Pedro Melin, Carlos Baier, Javier Munoz, Eduardo Espinosa, Hugo Gallardo and Luis Martinez. A Comparison Among Different Staggered Optimized Gating Patterns for Asymmetric Single-Phase Current Source Inverters	
			Abstract: In previous work, it was proposed to use multilevel current source converters to increase the current capacity as well as improve the harmonic profile of medium voltage and high current drives. Recent publications suggest that both (a) its intrinsic booster characteristics and (b) its easy way to handle independent DC sources operating in parallel make this topology an attractive alternative for the direct connection of photovoltaic plants to the grid. Furthermore, staggered optimized patterns were proposed together to modular topologies regarding the improvement on harmonic profile of injected currents to the grids. One of these techniques are the staggered Selective Harmonic Elimination. An alternative is the straightforward optimization for reduce the error among a time-based reference and the modulated current pattern. This work presents a comparison between two optimized techniques for the operation of staggered patterns in current source converters, for both symmetric and asymmetric cases. Theoretical results that are validated by simulation are presented.	CL
2		110	Allyfrahy Nunes Alves, Paulo Peixoto Praça, Demercil de Sousa Oliveira Jr. and Luiz Henrique Silva Colado Barreto. 1KW Amplifier Class D Design with GaN Switches	
			Abstract: With recent advances in Gallium nitride (GaN) semiconductor technology, it is possible to achieve greater applications in the power electronics market, allowing high switching speeds and high power conversion densities by transistors. This work presents application of GaN keys in the development of class D audio amplifier of 1KWrms in order to observe efficiency and losses generated in the switches, using complete bridge topology with unipolar modulation and proportional integrative derivative (PID) digital control. It obtains 97% yield on the amplifier and Total Harmonic Distortion (THD) of 0.23% through GaN switches and circuit simulations.	BR
3		123	Safaa Abdo Ibrahim, Salah Kamel, Mohamed H. Hassan and Loai Nasrat. Developed Algorithm Based on Supply-Demand-Based Optimizer for Parameters Estimation of Induction Motor	
			Abstract: One of the most important topics that receive great attention due to its environmental consequences is the issue of the optimal use of electrical energy. In other ways, the induction motors of most industries are the main component as they consume the highest percentage of energy and this consumption depends on the internal parameters that control the operating conditions of the motor. Due to the importance of internal parameters, which cannot be measured by electrical measuring devices, a determination process must be made to obtain them. Despite the success of applying many algorithms to calculate the parameters of induction motors, these algorithms have important defects; they often get suboptimal solutions as a result of an improper balance between exploitation and exploration in their search strategies. This paper applies a demand-based optimization (SDO) approach as an efficient and simple method for estimating equivalent circuit parameters of induction motors.	EG
4		128	Cristofer Millalaf, José Bello, Jaime Rohten, Marcos Andreu, Nathalie Risso and Javier Muñoz. Revision de Controles Predictivos en un Convertidor Estático Trifásico de Frente Activo	
			Abstract: This article presents a review of the predictive control techniques applied in a voltage source inverter to regulate the direct voltage (active power) and the reactive power injected into the grid. As Deadbeat and finite state control are based on the system model, they lead to a faster response and without overshoot, however, they are normally used in internal current control loops, in this case their applied behaviors are presented as such, but the application of a Deadbeat based on the general model of the static converter is also studied, thus contributing its advantages to the control of the DC voltage.	CL

	Tuesday	23	Track T54 Chair: Marco Rivera	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	17:30	133	Marco Rivera, Diego Rojas, Patrick Wheeler, Pericle Zanchetta and Galina Mirzaeva. A Study of Cost Function Selection in Model Predictive Control Applications	
			Abstract: The cost function selection is one of the most important aspects for the implementation of model predictive control strategies. In this paper a study of the most common cost functions used for the control of a two level voltage source inverter is presented. The paper introduces several cost function alternatives that could be considered for different applications.	CL, GB
2		135	Marco Rivera, Jose Riveros, Consuelo Rodríguez and Patrick Wheeler. Field-Oriented Control with a Predictive Current Strategy of an Induction Machine Fed by a Two-Level Voltage Source Inverter	
			Abstract: Motors in the industry require an optimal speed and torque control. This paper presents the implementation of a field-oriented control (FOC) with a predictive current strategy for an induction machine fed by a voltage source inverter. The FOC generates the stator current references for the predictive current controller, which is in charge of the selection of the optimal switching state to be applied in the next sampling instant.	CL, PY, GB

Track T5: POWER ELECTRONICS, cont.

	Wednesday	24	Track T55 Chair: Mario Fernández	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	16:30	137	Marco Rivera, Jose Riveros, Consuelo Rodríguez and Patrick Wheeler. Predictive Torque and Flux Control of an Induction Machine Fed by a Voltage Source Inverte	
			Abstract: Model predictive control strategies have emerged as a viable alternative for the control of power electronics applications. In this paper, a model predictive technique for the control of both flux and torque of an induction machine is presented. The algorithm selects from the available switching states of the voltage source inverter, the one that optimizes a cost function which is based on the tracking of the electromagnetic torque and the stator flux together with additonal criteria to ensure the proper operation of the machine. The results demonstrate the fast torque-flux response with a quasi sinusoidal stator currents during the operation of the system.	CL, PY, GB
2		138	Marco Rivera, Diego Rojas, Patrick Wheeler, Javier Muñoz and Carlos Baier. Predictive Current Control Applied to a 3L-NPC Inverter	
			Abstract: In recent years, Model Based Predictive Control (MPC) applied to power converters has been successfully presented as an alternative to traditional control techniques due to its fast dynamic response, ability to incorporate various control requirements in a cost function, among other attractive features. This work describes the fundamental aspects of the MPC, from its principle of operation to its application to multilevel power converters. The application of the MPC technique for a threelevel neutral point clamped inverter (3L-NPC) will be analyzed, taking into account the current control in a three-phase load, the balance in the capacitors link DC, and its dynamic response. The MPC method is theoretically analyzed and simulated in Matlab/Simulink with different sampling times.	CL, GB
3		146	Marco Rivera, Diego Rojas, Sergio Toledo and Patrick Wheeler. Predictive Voltage Control at Fixed Switching Frequency with Reduced Reactive Power in a Direct Matrix Converter	
			Abstract: Classical model-based predictive control leads to a variable switching frequency that may produce resonances in the input filter of the matrix converter, affecting system performance. The objective of this work is to apply the predictive control based on a modulated model at fixed switching frequency (M2PC) to the Direct Matrix Converter (DMC) in order to improve the power factor. The M2PC technique allows to control the output signals of the DMC, and, at the same time, allows the control of the input current and reactive power of the system. The discrete time model of the system, the input and output filter are used to predict the behavior of supply side reactive power and output signals for each valid switching state of the matrix converter. The simulation results using Matlab/Simulink confirm the optimal performance of the strategy.	CL, GB
4		147	Marco Rivera, Diego Rojas, Sergio Toledo and Patrick Wheeler. Reactive Power Control Using a Model-Based Predictive Control Strategy Applied to an Indirect Matrix Converter	
			Abstract: Reactive power is an issue of great concern for the operation of alternating current (AC) power systems. This work aims to apply the model-based predictive control (MPC) to the indirect matrix converter (IMC) to improve the power factor at the input of a system allowing to control the output current or voltage. Simulation results are carried out using Matlab/Simulink, where the objective is to observe, in the first instance, the control of the IMC output signals without reactive power control at the input and then, to contrast the results with the reactive power minimization observing the improvement of the performance.	CL, GB

Track T5: POWER ELECTRONICS, cont.

	Friday	26	Track T56 Chair: Mario Fernández	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	14:00	155	Patricio Pizarro, Matías Díaz, Felix Rojas, Mauricio Espinoza, Luca Tarisciotti and Oriol Gomis-Bellmunt. Novel Control Strategy for a Series-Parallel Modular Multilevel Converter in Wind Energy Conversion System Applications	
			Abstract: In recent years, the rated power of Wind Energy Conversion Systems (WECS) has been growing significantly, to this date, reaching power ratings above 10 MW per wind turbine. Consequently, Modular Multilevel Converters appear as a proper solution to replace conventional power converter in the power conversion stage of multi-megawatts WECS. This paper abords the application of a Shunt-Series Modular Multilevel Converters that interface a single WECS with a medium-voltage AC grid. It is proposed and studied a new control strategy that enables the decoupled operation at both ports of the converter as well as enables to track the maximum power point at the generator side. Simulation results are presented to validate both the proposed topology in WECS application and the control strategy applied.	CL, CR, ES
2		160	Guillermo Navarro, Felix Rojas, Matias Diaz, Javier Pereda and Gustavo Gatica. Design and implementation of dual active bridge converter with single phase shift modulation for electric vehicle charging system	
			Abstract: This article presents the implementation of a Dual Active Bridge converter with Single Phase Shift modulation, capable of controlling current and voltage at the converter output independently, through the design of simple PI controllers based on the model's transfer functions. small phasor signal.	GB
3		161	Luis Venegas and Javier Muñoz. Power Management Control Strategy for a Photovoltaic Micro-Inverter with Embedded Hybrid Energy Storage System	
			Abstract: A power management control strategy for a photovoltaic micro-inverter with embedded hybrid energy storage system is proposed. The analyses are focused on the performance of the control scheme for feeding a local load. Three levels of control are proposed. Primary control is directly applied to power converters to manage the energy flow based on the reference current tracking. The secondary control oversees regulating the DC Bus voltage by means of the power balance, which ensures that the load power is equal to the power in the DC Bus. The tertiary control is in charge of the system dynamics, that is, it is responsible for responding adequately to sudden changes. The primary control includes an input-output linearization control, allowing the use of linear controllers that are not limited to an operating point. A Maximum Power Point Tracking algorithm based on the incremental conductance is implemented on the photovoltaic panel. A suitable control scheme for the hybrid energy storage system is proposed to improve the performance of the micro-inverter and extend the lifetime of its components. Simulated results are presented to validate the properness of the proposed control strategy.	CL
4		162	Diego Verdugo, Felix Rojas, Matias Diaz, Javier Pereda and Gustavo Gatica. Modelling and control of a multi-cell converter based on Input-Parallel Output-Parallel bridge-cells with discontinuous interleaved modulation	
			Abstract: Multi-cell converters increase their current rating by adding more cells in parallel, if also the cells are interleaved the output THDi and input ripple get lower reducing the filter requirements. However interleaving causes circulating currents that need to be mitigated. This work proposes a model and control strategy that decouple the circulating currents from the output current under discontinuous modulation of a multi-cell converter based on Input-Parallel Output-Parallel (IPOP) bridge-cell. The discontinuous modulation eliminates the circulating current between one leg of the bridge cells. The proposed model and control are verified by simulations in Plecs.	CL

Track T5: POWER ELECTRONICS, cont.

	Friday	26	Track T57 Chair: Carolina Lagos	ROOM 3
#	Hora	Paper ID	Authors, title	Countries
1	15:45	165	Daniel Quezada, Camila Beltrán, Jaime Rohten, Nathalie Risso and Vladimir Esparza. Linear Quadratic Control design for a Buck-BoostPower Converter supplied by a Solar array	
			Abstract: Renewable energies have gained the attention ofsociety, governments, and researchers for bringing solutions tothe growing necessity of continuous energy supply for homes andindustries. Great efforts are being made to develop and adapttechnologies that make possible to harvest inexhaustible sourcesof energy such as wind, solar, waves, etc. There are differentstages associated to renewable energy injection: the first one isthe energy extraction, this can be implemented with solar panels,turbines, etc.;the second stage considers power conversion, and inthe final stage, transformers make possible energy transmissionto users. This paper focuses in the design of a suitable controlstrategy for a power converter to inject energy from solar panels,tracking the maximum power point. In this paper, an optimalcontrol strategy is tested in a Buck-Boost power converter whichis capable to vary the voltage at the first stage to follow theinputs and extract the maximum amount of power, in spite ofbounded variations in irradiance and temperature. Particularly, aLinear Quadratic Regulator (LQR) is combined with a KalmanFilter (KF) to regulate a Buck-Boost output for the rejectionof constant disturbances, thus mitigating measurement noise.Obtained results show that the proposed controller achieves anacceptable performance for the target setting.	CL
2		191	Efrain Ibaceta, Matias Diaz, Matias Uriarte, Felix Rojas, Arturo Letelier and Roberto Cárdenas. Power Loss Ride Through Control Strategy for Variable Speed Drives based on the Modular Multilevel Matrix Converter	
			Abstract: Modern variable-speed drives must be able to ride-through faults and contingencies such as power interruptions and grid-voltage dips to ensure the continuity of the process and avoid undesired detentions that might be costly. Therefore, the Power Loss Ride-Through behaviour of variable-speed drives is an important feature. Recently, Modular Multilevel Cascade Converters have been applied in Variable Speed Drives applications due to their capability to operate at high-power rates and features such as enhanced fault-ride through capability. Therefore, this paper presents a control strategy to improve the Power Loss Ride- Through performance of a Modular Multilevel Matrix Converter drive. Simulation results obtained using PLECS software are presented to validate the effectiveness of the proposed control strategy.	CL
3		204	Diego Rojas, Marco Rivera and Pat Wheeler. Predictive Current Control Strategy for a Multi-modular Matrix Converter	
			Abstract: Matrix converters have been mainly limited to the low power range. Multi-level voltage source converters are used for high power applications. In order to combine the characteristics of both topologies, this work shows the principle of operation of multi-modular matrix converters. Among all the proposed control techniques, predictive control has become a plausible and highly versatile option due to its ability to cope with different requirements. This work proposes to implement the predictive control technique at a fixed switching frequency applied to the multi-modular matrix converter, and a comparison of the performance between the proposed control and the variable switching frequency counterpart, showing the advantages and disadvantages between the two strategies.	CL, GB

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Track T6: Instrumentation & Communication

	Monday	22	Track T61 Chair: Héctor Kaschel	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	16:30	6	Darwin Aguilar, Rita León, Jonathan Viscarra and Daniel Domínguez. Implementation of a Mobile Jamming Prototype for drones in the 2.4 GHz Band.	
			Abstract: This work describes the implementation of a jammer prototype implemented on a drone that is activated by an operator agent. In the implementation process, a prototype reconfigurable Antenna Microstrip Type E was developed that guarantees signal propagation in 2.4 and 5.8 GHz. The jammer control stages in the drone were also designed, consisting of data acquisition cards, sensors detection photoelectric and wireless communication cards, allowing the operator to decide the exact moment to carry out the attack. In addition, a remote control has been implemented that allows the operator to know the physical position of the target with respect to the position of the attacking drone. Finally, the operational tests were carried out in two stages, in the laboratory, analyzing the spectrum generated by the jammer, and in the field, which includes jamming tests on a commercial drone. Thanks to the results obtained, the operation of the prototype that inhibits the video transmission of the attacked target was verified.	EC
2		14	Rolando Andrade and Javier Cabrera. DESIGN AND IMPLEMENTATION OF AMI SYSTEM OF ELECTRIC AND WATER METER	
			Abstract: The energy demand is increasing worldwide. This is attributed to the population growth and industrial development. This is why having a more precise idea of energy consumption improves its efficiency, thus reducing system failures, as well as excessive and unnecessary expenses. At present, there are major developments in smart meter technology, both electrical and water. This article presents the proposal for an AMI system, made up of an intelligent meter, which measures electricity and water consumption, and which, through ethernet communication, brings this data to ThingSpeak, a free IoT platform, for monitoring and diagnosis in real time by end user. In addition, it offers notifications when the signal obtained is outside a previously specified range. The results obtained during the tests of both smart meters were good, with errors of less than 2% in each of the sensors. Similarly, the graphical interface is easy to use, with illustrations of the most important variables for users.	EC
3		32	Washington Fernandez and Krzysztof Herman. Non-Binary Quasi Perfect Code for Noise Channel Class A	
			Abstract: In this article are designed non-binary quasi perfect codes that can correct errors of burst of dimension: 1, 2, 3, 4 and 5. According to the results obtained, these codes are optimal for transmission channels that have noise of class A, because they lower in a very significant way the probability of error symbol on the receiver.	CL
4		41	João Carlos da Cruz de Lima and Emanuel Bezerra Rodrigues. Quality of Service Control in Software-Defined 5G Networks	
			Abstract: With the evolution of communication technology, new applications have emerged in order to improve the processes of information exchange and innovation, at the forefront of this evolution is the fifth generation of mobile networks (5G), which aims to improve capacity, reliability and energy efficiency, while reducing latency and greatly increasing connection density. In this context, there are a series of changes to be made in the network infrastructure, including Core Network (CN) and Radio Access Network (RAN) to support these new applications. In this work we present the Quality of Service (QoS) control in the (CN) in an abstract way, through the Software Defined Network (SDN) as a way to solve the throughput traffic challenge. Through the experiments carried out with the Ryu SDN controller, results were obtained that demonstrated that the application of QoS in the simulated environment, can bring benefits to the performance of these new applications.	BR

Track T6: Instrumentation & Communication, cont.

	Tuesday	23	Track T62 Chair: Héctor Kaschel	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	14:00	42	Washington Fernandez and Krzysztof Herman. Results preliminary of the Performance of Non-Binary Quasi Perfect Code for Noise Channel Class A	
			Abstract: In this article are designed non-binary quasi perfect codes that can correct errors of burst of dimension: 1, 2, 3, 4 and 5. The performance on a channel with noise class A is studied. According to the results obtained, these codes are optimal for transmission channels that have noise of class A, because they lower in a very significant way the probability of error symbol on the receiver.	CL
2		50	Jorge Álvarez, Fausto Granda, Darwin Aguilar and Diego Guzmán. Wireless Communication of BioSensors in the Human Body: Analysis and Simulation of Signal Propagation model.	
			Abstract: The Biosensors are a current technology that is being developed and perfected for the health care of the human body. The communication in the Biosensors network is affected by different factors; one of them is the dielectric characteristics of the human body parts. In this way, this research proposes a propagation model based on realistic simulation performed in FEKO software whose results were compared with real-time field measurement. The propagation model makes use of the foundations of the Friis equation for a multilayer that considers the dielectric characteristics of the skin, bones, muscle, and fat. The propagation losses were quantified as a function of the distance traveled by the wave in the human being. The results found show a correlation between propagation losses and factors such as age, height and concentration of adipose tissue. On the other hand, the presence of fluids such as blood in the muscles allows us to observe that there is a gain in propagation due to the dielectric properties of conductivity of certain fluids present in the human body.	EC
3		55	Judy Abi Nehme, Charbel Nicolas, Gilbert Habib, Nicolas Haddad and Cristian Duran-Faundez. Experimental Study of Lora Performance: A Concrete Building Case	
			Abstract: Wireless technologies offer many advantages in communication between Internet of Things (IoT) devices, yet, it lacks in performance especially indoors where walls, metal, and other objects deteriorate their performance. LoRa is a new technology that may offer better indoor performance. In this article, we present and analyze LoRa's parameters, and aim to optimize them for use in a reinforced concrete building. Our experimental results show that increasing the spreading factor (SF) and coding rate (CR) increase the packet transmission duration, which has a detrimental effect on the packet reception ratio. Moreover, our main contribution is that we propose an optimized configuration that results in a higher packet reception ratio in an indoor environment.	LB
4		82	Hector Kaschel, Sergio Cordero, Eduardo Costoya and Marcelo Pandolfo. Comparative Analysis of the Two Ray Field Strength on Radio Mobile ITM Model and Recommendation ITU-R P.1546	
			Abstract: This document represents the continuity of a research series on the behavior of radio propagation by the Irregular Terrain Model (ITM) from National Telecommunications Institute (NTI – USA), under certain operation conditions known as the 2-Ray mode on Line of Sight links (LOS). The research has been conducted on 24 links under several LOS conditions and terrain data. Then compared with ITU's (International Telecommunications Union) P.1546 and conclusions have been extracted and procedures recommended. Future work will include further research with new terrain data available from NASA.	CL

Track T6: Instrumentation & Communication, cont.

	Tuesday	23	Track T63 Chair: Carlos Muñoz	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	15:45	93	Fabián Vinicio Corral, Christian Cuenca and Ismael Soto. Design of an Optical Wireless Network using Free Space Optics Technology (FSO), in 5G/6G Networks Environment	
			Abstract: We propose a free-space optical system for the current network topology of university campus buildings and the Astronomical Observatory, at Quito, Ecuador. Using wireless optical communication provides the advantages of a wireless environment and faster data transfer rate. The Free Space Optics (FSO) design considers the worst atmospheric condition (torrential rain and fog) where the visibility value is 770 meters. The obtained atmospheric-attenuation coefficient is 3.84 dB/Km. Link margin values calculated between 4.74 dB to 43.99 dB allow validating the FSO network design. The FSO cost implementation is almost equal than a fiber optic alternative, which makes this technology very attractive for Optical Wireless Communications (OWC) in the 5G/5GB/6G network environment	EC, CL
2		97	Nicolas Ruminot, Claudio Valencia and Rodrigo Abarzua. Side Channel Attack Countermeasure for Low Power Devices with AESEncryption	
			Abstract: The advancement of technology Internet of Things produces a massive increase in the use of low-power devices, which can contain sensitive information. Most of these devices do not have the necessary security to protect their information. Therefore, this research aims to analyze and compare countermeasures for SCA in low-power devices with 128-AES encryption. In this scenario, we analyze existing countermeasures and conclude that algorithm-based countermeasures are more suitable for low-power devices. Subsequently, we run a set of tests to understand the scope of CPA attacks and thus establish a countermeasure that is tailored to these devices. Finally, we propose a countermeasure based on byte logic, comparing it with traditional countermeasures of the same type.	CL
3		100	Carlos Corral and Claudio Valencia. BER and SNR based physical layer security analysis with cooperative Jamming	
			Abstract: Physical layer security has been widely studied by the scientific community from a theoretical point of view, but the lack of practical metrics that can deliver a quick and easy-to-read response for the communications engineer makes it difficult to implement this type of security in current technologies. That is why this article proposes two practical metrics derived from the Bit error rate (BER) vs Signal to noise ratio (SNR) that quantify the security against the eavesdropper and the readability of the message in the legitimate receiver, finding a feasible power distribution for transmission.	CL

	Tuesday	23	Track T64 Chair: Carlos Muñoz	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	17:30	131	Ginno Millán, Román Osorio-Comparán and Gastón Lefranc. Preliminaries on the Accurate Estimation of the Hurst Exponent Using Time Series	
			Abstract: This article explores the required amount of time series points from a high-speed computer network to accurately estimate the Hurst exponent. The methodology consists in designing an experiment using estimators that are applied to time series addresses resulting from the capture of high-speed network traffic, followed by addressing the minimum amount of point required to obtain in accurate estimates of the Hurst exponent. The methodology addresses the exhaustive analysis of the Hurst exponent considering bias behaviour, standard deviation, and Mean Squared Error using fractional Gaussian noise signals with stationary increases. Our results show that the Whittle estimator successfully estimates the Hurst exponent in series with few points. Based on the results obtained, a minimum length for the time series is empirically proposed. Finally, to validate the results, the methodology is applied to real traffic captures in a high-speed computer network.	CL, MX
2		185	Hector Alejandro Gonzalez Vidal, Pablo Andres Diaz Paredes, Jose Manuel Toledo Romero and Silvia Elena Restrepo Medina. Design of a simulation system of occupancy in Smart homes based on IoT	
			Abstract: This research work consists in to design a simulation system of occupancy in smart homes based on IoT, in order to create configurations within a home that make look like the daily behavior of home inhabitants. The IoT system is based on a motion sensor, actuators as relays and lights, Arduino platform to control system, and a Amazon Echo virtual assistant to interface with inhabitants. The results demonstrate that security system create an environment occupied by owners without to be inside home, through sensors and actuators.	CL

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Track T7: INFORMATICS & EDUCATION

	Wednesday	24	Track T71 Chair: Ernesto Rubio	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	16:30	35	Hector Kaschel, Pedro Palominos, Rodrigo Martin, Juan Barrientos and Jose Quiroga. Technological Architecture for Open Smart Cities	
			Abstract: Rapid urban growth as a result of migration from rural to urban areas, reaching a urbanization rate of 68% by 2050, has put pressure on cities in their management, planning and development, which has generated major problems such as pollution, urban inequality, mobility among other challenges. In recent years a new paradigm has emerged to face these challenges and it is the concept of smart cities and lately of Open Smart Cities One of the fundamental pillars to transform cities into smart cities is to have an enabling ICT infrastructure. In this paper, the state of the art of technological architecture is presented to achieve Open Smart Cities.	CL
2		38	Leonardo Benavides Maldonado, Roberto Jacome, Hernán Castillo García, Estefanía Salinas and Jamil Ramon. Metodología de evaluación por competencias, para Laboratorios de Ingeniería en Línea	
			Abstract: —(This article shows a new way of evaluating online based on competencies, Flipped Learning (flipped class), which combine very well with other learning methodologies such as just in time teaching (just in time teaching), where the Previous knowledge that the student has, thus reinforcing those who are delayed, for this he is given a previous audio visual material, of the subjects of Automatic Control-National University of Loja (UNL). In the periods September 2014-September 2018, respectively, in Ecuador. Finally, it is presented which capacities are the ones that stood out the most, considering that each there are multiple intelligences for learning	EC
3		91	Renato Castañeda, Renato Guerrero, Bruno Renteros and Alejandro Villanueva. Detection of nutrient deficiencies in banana plants using deep learning, Iván Belupú	
			Abstract: Due to the vast extension of banana plantations, the control of nutrients in the soil becomes more complex, and reduces the practicality of conventional methods for measuring nutrients through laboratory tests, due to their inability to be carried out on site. Poor nutrient management in any of their development stages leads to a decrease in farmers' yield (both in quantity and quality) and risk a failure to meet the standards and demand of the export market. This growing problem makes necessary the development of an alternative, fast, efficient, reliable, and mobile method that allows a better monitoring of the nutritional composition of the cultivation soil. he present work proposes a solution to this need by building a prototype of a platform for identifying chemical deficiencies through image recognition of banana leaves using a convolutional neural network trained with transfer learning and fine tuning. An original dataset of photos was used in this research, which is composed of healthy banana leaves images, and leaves with known deficiencies of nitrogen, potassium, and phosphorus. Subsequently, an augmentation is performed to this dataset through linear transformations. The resulting images were pre-processed in different color spaces to be used as inputs to the neural network. Various metrics and a confusion matrix were employed to validate results.	PE
4		105	Gabriel Diaz, Orietta Nicolis and Billy Peralta. Visual recognition incorporating features of self-supervised models for the use of unlabelled data	
			Abstract: Automatic visual object recognition has gained great popularity in the world and is successfully applied to various areas such as robotics, security or commerce using deep learning techniques. Training in machine learning models based on deep learning requires an enormous amount of supervised data, which is expensive to obtain. An alternative is to use semi-supervised models as co-training where the views given by deep networks are differentiated using models that incorporate lateral information from each training object. In this document, we describe and test a co-training model for deep networks, adding as auxiliary inputs to self-supervised network features. The results show that the proposed model managed to converge using a few dozen iterations, exceeding 2 % in precision compared to recent models. This model, despite its simplicity, manages to be competitive with more complex recent works. As future work, we plan to modify deep self-supervised networks to increase diversity in co-training learning.	CL

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IEEE IFAC ICA ACCA 2021

Track T7: INFORMATICS & EDUCATION,cont.

	Thrusday	25	Track T72 Chair: Ernesto Rubio	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	14:00	108	Billy Peralta, Jorge Salazar, Marcos A. Levano and Orietta Nicolis. A causal modelling for desertion and graduation prediction using Bayesian networks: a Chilean case	
			Abstract: Currently the high rates of university dropouts and low graduation are social problems that are very relevant in Chilean society. Predicting these events can allow institutions to take action to avoid them. The typical prediction models based on machine learning are capable of making reliable predictions, however they do not allow to understand the causality that originates both events, which could help to take better actions. This work proposes to find, analyze and weigh the causal relationships that allow predicting whether a student will drop out or will graduate according to the information available using a framework with Bayesian networks. The study is based on real data from the Universidad Catolica de Temuco in Chile collected ´ over three years. The results reveal variables and relevant relationships according the opinion of human experts, which suggest that the proposed model provides better capabilities to represent the causality of university dropout and graduation. From the results we believe that it is feasible to design better retention policies and timely degree at a university.	CL
2		115	Daniel Leonardo Barrera Esparta, Luis Fabrizzio Cerrillo Guillen, Franck Edwin Góngora Zevallos, Alain Andres Yance Paucar and Nestor André Orellana Oyarce. Design of a Wear Estimator for liners in SAG Mills using ANFIS modeling	
			Abstract: In grinding, the SAG mills are used because of its capacity and short retention time for the processing of minerals and metals. The measure of liners wears in SAG Mills requires a shut down operation, that implies high costs when it is necessary to change liners suddenly. This paper proposes the use of an Adaptive Neuro Fuzzy Inference System method (ANFIS) for modeling a wear estimator for liner in SAG mills, which will train the network to obtain adequate indicators for the comparison in different configurations. The best response is obtained with a network using accumulated input values of variables taken from the SCADA system.	PE
3		119	Nestor Orellana Oyarce, Daniel Barrera Esparta, German Baca Espinoza and Alhiet Orbegoso Guerrero. Supervised learning algorithms for estimation of liners wear in SAG Mills	
			Abstract: The measurement of wear in the liners of SAG mills is performed with the machine stopped and entering inside in a short available stopping time. Thus, the height estimation of liners will save time and costs when liners are changed. This paper proposes an estimator of liners height in SAG mills from three-stage process data using Machine Learning algorithms for supervised learning. Two models of estimation were proposed and trained based on the information acquired and processed by the SCADA system of the process.	PE
4		120	Liliana Martinez, Fernanda Lozano and Alejandro Maturano. Bubble classroom with VLC in higher education	
			Abstract: ble Light Communication (VLC) have increased the knowledge about the multiple contributions of this new technology to satisfy the needs of different social, educational, health and production fields. The post-pandemic situation present in all the countries of the world has generated the need to seek new forms of organization in university educational institutions and strategies to favor access to classrooms within virtual platforms during the implemented quarantine stage and create other alternatives to the postpandemic stage. This new stage will require reorganization, spaces, times and conditions in the classrooms where the classes are held. The objective of this work is to identify the needs and obstacles to implement bubble classrooms in Engineering and Technology careers for synchronous and asynchronous face-toface activities in the post-pandemic stage, with the teacher or specialists in their area in order to strengthen their professional training. The selected methodology was quantitative and made it possible to collect, through online surveys carried out with students, data on the possibilities and difficulties of connectivity of students in face-to-face classes and their appreciation of the change proposed in this work, when applying this model of bubble classrooms connected through the LI-FI Technology, the access to knowledge of the students is favored that with an LED lamp directed to each of the computers and transceivers they can have Internet at low cost throughout the development of the classes.	AR

Track T7: INFORMATICS & EDUCATION,cont.

	Thrusday	25	Track T73 Chair: Lisbel Bársaga	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	15:45	134	Daniel Bustos, Jonathan M. Palma, Maira Vidal, Wendy González and Erix W. Hernández. Brief tutorial to evaluate molecular cavities in large conformational ensembles: a K2P channel study case	
			Abstract: In structural bioinformatics, computational biology, or any other field where is important to assess cavities, clefts, pores, or grooves in a macromolecular system, it is imperative to perform this evaluation over a trajectory or an ensemble of structures to measure all possible structural changes produced by the atomic movements, especially in the constriction regions. This is mainly true in membrane proteins such as ions channels or transporters where the movements of the amino acid residue side chains that form the pore can significantly alter their dimensions and thus affect the protein function. In this work, we present a brief tutorial to measure the radius of the pore within macromolecules in large structural ensembles using non-commercial software widely reported in the literature.	CL
2		152	Antonio Rienzo, Claudio Cubillos and Gabriela Soto. Gamification Elements in Digital Applications for the Evaluation and Cognitive Training of Older Adults.	
			Abstract: It has been suggested that gamification is being applied in various types of disciplines. An area of growing research is the use of digital applications (in the form of games), for the evaluation and training of the cognitive abilities of the elderly, a segment of the population that is constantly increasing. The work presents, based on a systematic literature review, a synthesis of the results of case studies of researchers who propose that gamification and serious games can be used for the evaluation, diagnosis and timely detection of cognitive impairment of the older adult, and subsequent stimulation and training to improve the cognitive abilities of these people. Technological solutions that have been implemented through mobile applications, web games, virtual reality, and serious games are presented. The main components of gamification are analyzed to evaluate certain skills. The main aspects that should be considered in the design of a game for cognitive training are also presented.	CL
3		157	Fabricio Salgado, Daniel Jiménez, Iván Santelices and Nathalie Risso. Validating Bachelor of Engineering Competencies: An Internship-based approach	
			Abstract: During the last decade, Engineering programs in Chile have shifted their focus from a traditional content-based model to a competency-based model. Although this approach has become popular and integrated into engineering programs, its effectiveness has not been fully validated. In particular, currently there are no tools that allow verifying compliance with the competencies declared in the professional and bachelor's degree programs offered by the Faculty of Engineering at the Universidad del Bio-Bio. In this project, a survey-type instrument is validated for the evaluation of acquired graduate competencies, defined in Engineering programs at Universidad del Bio-Bio. Here, validation was carried out considering students from 2018- 2019 cohorts from Industrial Civil Engineering and Electrical Civil Engineering programs.	CL

	Thrusday	25	Track T74 Chair: Lisbel Bársaga	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	17:30	168	Natasha Milena Do Santos da Silva, Ania Lussón Cervantes, Flavio da Silva Vitorino Gomes and Reinel Beltrán Aguedo. Supervision and control system of a didactic plant in the teaching of industrial automation and control	
			Abstract: This article presents a supervision and automatic control system of the pilot plant present in the Laboratory of Instrumentation, Automation and Control (LIAC) at UACSA-UFRPE, aiming to cover the first three levels of the automation pyramid: field devices, control and supervision. The system architecture consists of two reservoirs, a programmable logic controller S7-1200, sensors, actuators, and the Elipse SCADA and Matlab software. The methodology for modeling using experimental identification for the level system is presented applying an input step to the plant, with the data being accessed from the supervisory system by the network through the OPC protocol. With the model obtained, simulation and experimentation results are presented using the Proportional-Integral (PI) control strategy for changes in the reference. Finally, a plant supervision and control system and a human-user interface are developed, allowing supervision of the four process variables: level, temperature, pressure and flow, and the level control in the upper reservoir. In addition, it is possible to manage alarms, historical records and reports, for decision making in failure prevision, maintenance and troubleshooting.	BR
2		181	Nahur Manuel Meléndez Araya, José Gallardo and Carlos Vernal Navarrete. Application of educational robotics in rural students of the Atacama region	
			Abstract: Rurality has traditionally been a factor of marginalization in education, and it persists as a barrier that affects the progression of students in the educational system. Educational Robotics (ER) has its origins in Papert's constructionism, it is not simply assembling robots, it is a very versatile learning tool that allows working in different areas of knowledge. The objective of the article is to present information regarding the use and acceptance of ER by students from rural establishments in the Región de Atacama; The work methodology used was proposed sequentially and divided into groups of activities: i) Hypothesis Approach, ii) Definition of Methodology and Assessment Instruments, iii) Development of ER Activities, iv) Documentation and v) Analysis of Results. The information obtained after the results shows that the efficient and effective use of ER depends to a great extent on the level of ownership that the participants present in this regard, quickly becoming accustomed to the robot, carrying out participatory interactions between peers and oriented towards learning and solving problems.	CL

PROGRAM BY TRACKS

IEEE IFAC ICA ACCA 2021

Track T8: INDUSTRY & OTHERS APPLICATIONS

	Thrusday	25	Track T81 Chair: Gastón Lefranc	Room 3
#	Hora	Paper ID	Authors, title	Countries
1	14:00	13	Daniel G. Costa and Joao Paulo J. Peixoto. On the mathematical modelling of visual sensors when computing coverage metrics in camera-based sensing applications	
			Abstract: When designing and implementing visual sensor networks, mathematical models are frequently used to support better deployment strategies and quality assessment metrics in applications such as Smart Cities and Industry 4.0. However, the literature in this subject is not uniform and there are more than one way to model a visual sensor. This paper presents different mathematical models and useful equations that can be employed when computing coverage, comparing them for different scenarios when analyzing coverage performance and computational costs. Moreover, a simulation scenario is defined considering a typical visual monitoring application in an industrial plant, presenting coverage results for both visual sensing models. Analyzing their mathematical costs, researchers can better decide which model and configuration parameters are more suitable for their needs, benefiting new works in this area.	BR
2		37	Iván Merino Ortega, Daniel Marcelo-Aldana, Elder Mendoza Orbegoso and Raúl La Madrid Olivares. Mathematical Modeling of a Bubbling Fluidized Bed Gasifier	
			Abstract: This research is focused on the development of a one-dimensional mathematical model (with respect to the height of the reactor) of fluidized bed gasifier in a bubbling regime at atmospheric pressure by means of simulation by numerical methods with the use of MATLAB, based on the Theory of the Two Phases (emulsion and bubble). The model developed through empirical equations proposed in several publications, allows the prediction of the energy quality (PCI) and the composition of the synthesis gas throughout the height of the reactor during the gasification process, by estimating the molar flows of the main volatile species produced (CO, CO2, H2O, H2, O2, CH4, N2 and char). In addition, the model has been validated with research using the values of the molar fractions of hydrogen (H2), carbon monoxide (CO) and methane (CH4) obtained experimentally.	PE
3		48	Manuel T. Ibáñez-Barrios and Xaviera A. López-Cortés. X-MassFP: a platform with focus on pattern research for mass spectrometry fingerprint recognition	
			Abstract: Pathogens are infectious microorganisms that lodge in a host and are responsible for generating diseases. In many cases the detection of pathogens is expensive in resources and time, in addition, the necessary technology must be available to detect them. Mass spectrometry is combined with machine learning techniques to produce fast, efficient, and low-cost pathogen detection. We propose an automated desktop platform named X-MassFP to analyse and train predictive models based on supervised machine learning capable of identifying pathogens based on m/z data from mass spectra. Previous research analyzes of serum samples from healthy and diseased salmonids with Piscirickettsia salmonis were obtained and used to perform multiple alignment and binning experiments with the platform. Then, many combinations of pipes were made to obtain the best model. Different bin sizes and attribute selectors were used, as well as the use of oversampling on unbalanced data sets. The best results obtained from the X-MassFP pipes corresponds to KNN using multiple alignment and SVM using the binning method, with 90% and 88.8% of accuracy, respectively.	CL
4		51	Lizardo Pari and Christian Mamani. Desarrollo aplicación robótica con voz para guiado de personas con discapacidad visual en ambientes cerrados basado en ROS	
			Abstract: Blindness is one of the most widespread disabilities in people around the world, these people cannot lead a normal life due to the limitation of their movements even in their homes. Most of them need the assistance of someone or something. This leads several investigators to develop various devices for the independent navigation, but many of them are developed for a specific task or are very expensive despite being in robotics boom. In order to obtain an independent navigation, it requires a high-performance device. In this article we developed a robotic application that would be operated with voice commands which indicate the destination for indoor and associate them to a coordinate of the map created based on Turtlebot 3, Pocketsphinx and Robotic Operating System (ROS) and Text to Speech (TTS) like Talkey, of this way the robot guides the patient to his destination through a path that this traces it. Tests were carried out for verification on blind patients from a rehabilitation center.	PE

Track T8: INDUSTRY & OTHERS APPLICATIONS, cont.

	Thrusday	25	Track T82 Chair: Gastón Lefranc	Room 3
#	Hora	Paper ID	Authors, title	Countries
1	15:45	71	Claudia Durán and Fredi Palominos. Analysis of synergistic relationships between types of actors in a port system	
			Abstract: The synergistic interactions between the actors of a complex system reflect the health of the ecosystem generated by the set of rules and regulations that comprise it. This paper addresses a study of the synergistic relationships between different groups of actors involved in the operation of a Chilean port system. The results of the study are consistent, coherent and logically explainable considering the type of interaction and the type of company involved. It is evident that it would be advisable to have a greater synergy between some types of actors, however, as these relationships are strongly marked by the goals and purposes of the companies, it is necessary that the improvement of the ecosystem does not affect the plans and purposes, but rather that the channel towards greater harmony between all actors, benefiting the public and private sectors and the State itself.	CL
2		74	Esteban Toledo-Mercado, Ismael Soto, Juan Quiroz, Jonathan Pereira-Mendoza and Raul Zamorano-Illanes. Adaptive Digital Filter using NARX Deep Neural Networks for ground-based observatories	
			Abstract: This paper presents two methods using Big Data and Machine Learning techniques for the development of a digital filter using a NARX Deep Neural Network to remove atmospheric noise from astronomical signals. The data was prepared through an unsupervised and a supervised method, using actual data from the WASP 19 Exoplanet WASP19-b star and the reference light curve based on Mandel Agol's model	CL
3		86	José Mardones, Rodrigo Acuña and Emil Osorio. Smart Greenhouse for economic reactivation	
			Abstract: Horticulture at Los Ríos Region it keeps as subsistence activity with low scale seasonal productions and weak articulation with market. In spite of economic and productive potential of heading, demand is supplied with a majority stake of "imports" from other regions. Added to the above, adverse weather, scarce technology incorporation, inefficient energy use, weaknesses in the business model, prevent adequate resource exploitation. Greenhouse is a tool to avoid several difficulties mentioned, but the model used are brought from central area of Chile, then then don´t comply with all conditions for good results. This work describe the introduction of technological package for automate the control of several variables adapted to an specially architectural design for southern conditions and that has as a main constraint a value not higher than CL$ 4.000.000.- For that, the electronic design of control system and his post-maintenance process must be easy and cheap.	CL
4		98	William Ipanaqué, César Belupú and José Castillo. Implementation of a stainless steel prototype to improve the fermentation of cocoa beans	
			Abstract: The fermentation of cocoa in wooden boxes has disadvantages that mainly affect the organoleptic properties such as taste, smell, acidity, in addition, the temperature of the entire product cannot be kept uniform, which affects the final quality. In order to improve this process a stainless steel prototype was developed, consists of a mechanical system that carries out the extraction of cocoa beans at the speeds necessary for a homogeneous fermentation. In addition, it consists of an insulation that prevents loss of heat and humidity in the grains and an area for collecting mucilage. As a result, the tests demonstrated a more homogeneous fermentation at the temperature of the whole cocoa with the steel fermenter than with the wooden boxes.	PE

Track T8: INDUSTRY & OTHERS APPLICATIONS, cont.

	Thrusday	25	Track T83 Chair: Gastón Lefranc	Room 3
#	Hora	Paper ID	Authors, title	Countries
1	17:30	109	Eduardo Correa, Melannie García, Gustavo Grosso, José Huamantoma and William Ipanaqué. Design and Implementation of an CNN Arquitecture to classify images of banana leaves with diseases	
			Abstract: Piura is an agricultural region, and therefore, crop production is one of the primary sources of income. Competition in this sector has been growing in recent years, and Piura cannot be left behind. Due to factors such as diseases, pest attacks, and sudden changes in climatic conditions, the level of crop production decreases. Automatic recognition of plant diseases is essential to automatically detect disease symptoms as soon as they appear in the growing stage. This paper provides a proposed methodology for the analysis and detection of banana leaf diseases using digital image processing techniques. The results obtained show that the proposed system can successfully detect and classify two major banana leaf diseases: Black Sigatoka and Bacterial Wilt (BBW).	PE
2		117	Daniel Caravantes, Juan Yeng, Kevin Cotrina, Brain Amaya,Juan Valdiviezo and William Ipanaqué. K-means clustering algorithm approach for the segmentation of organic banana producers according to production ratio	
			Abstract: In Peru, the exportation of organic bananas has increased considerably in the last ten years, the arrival of the "boom" of organic bananas is imminent, therefore it is necessary better management of small producers and associations for this organic resource, providing them with new technologies that help them to better organize, develop and monitor production. In the present study, a segmentation algorithm based on k-means has been developed, through which it was possible to group the weekly production of an organic banana packhouse, formulated on its production ratio. This project has been carried out to facilitate the monitoring of the production of each sector of the agricultural cooperative APBOSMAM (Asociación de Productores de Banano Orgánico Sector el Monte y Anexos Mallaritos), which provided production data. In the development of this study, two production ratios have been considered for the analysis: “Plant population per hectare ratio” and “Pre-bagged bunches ratio” by each sector during a week. From formed groups, it has been possible to identify the sectors with the lowest production and the possible factors causing this low contribution at the time of exporting the fruit.	PE

Track T8: INDUSTRY & OTHERS APPLICATIONS, cont.

	Friday	26	Track T84 Chair: Felisa Córdova	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	14:00	121	Marcia Gaspar and Martha Ramírez-Valdivia. Elements for the implementation of ISO / IEC 17025 in Angolan public laboratories	
			Abstract: The implementation of the ISO / IEC 17025 standard is of vital importance to certify the quality of the results of agri-food laboratories. This paper presents the results of the application of instruments to various interested parties in order to determine the elements that facilitate or hinder the implementation and use of said regulations in Angolan public laboratories. The results show that the participation of senior management, the availability of resources, and the training of personnel contribute to the success of the implementation.	CL
		126	Michael Dorin, Sarija Janardhanan and Sergio Montenegro. Software Streamlining: Reducing Software to Essentials	
			Abstract: Software products tend to become more sophisticated as they are actively maintained and used. While new software sophistication provides updated functionality, an undesired result of the expansion is the arrival of complicatedness. One obvious consequence of the new complicacy is an opportunity for new bugs. However, another often overlooked result is the increased difficulty of use and the greater demand for operational resources. It is also apparent that not all applications require all the features provided by software systems, and in many cases, only a small subset of features is ever used. With this in mind, we suggest a development paradigm of taking an existing software product and streamlining it into a smaller and less complicated version, which provides only a useful subset of essential functionalities. To demonstrate this new workflow feasibility, we take the existing aerospace operating system RODOS and adapt it to a smaller and less complicated version. The results show it is possible to make software less complicated, easier to use and improve resource economy.	US, DE
2		163	Stefany Monasterio, Diego Fuentealba, José Alejandro Pérez, Eduardo Viera, Carolina Lagos and Raúl Carrasco. Video Game Addiction: Consequences and Treatments	
			Abstract: Addiction to video games is a disease recently recognized by the WHO that could increase due to the conditions of confinement caused by the pandemic resulting from COVID-19. This paper investigates the types of addictions, including the consequences of video game addiction in people. Research articles are analyzed, finding that the excessive use of video games is considered a behavioral addiction and is recognized by the DSM-5 as a mental disorder. The relationship between video games and the identified consequences is discussed, where it is proposed a set of consequences and treatments based on the literature review. However, there is still a lack of information about how to know if a gamer is addicted and how to treat the disease efficiently and safely.	CL
3		166	Angel Aguilera, Gloria Henriquez, Karina Barbosa and Javier Borquez. A Simple Electrical Model of the Left Ventricle of the Human Heart	
			Abstract: In this work, a more intuitive electrical model of the left ventricle is proposed to encourage people from the electrical engineering area to get involved in the area of the medical sciences. Initially, the basic principles of the cardiovascular system are compared with electrical elements. Next, a simplified electrical model is then proposed based on a healthy person's ventricular pressure and volume curves. Finally, the proposed model is validated through numerical simulation and compared with the hemodynamic parameters of a healthy adult's cardiovascular system.	CL

Track T8: INDUSTRY & OTHERS APPLICATIONS, cont.

	Friday	26	Track T85 Chair: Felisa Córdova	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	15:45	169	Hugo Garces, Eduardo Morales, Eduardo Espinosa, Hans Cabrera, Alejandro Rojas, Luis Arias, Paulo Rivera, Gonzalo Carvajal and Andres Fuentes. Data analytics tools by alarms visualization and artificial intelligence applied in industrial monitoring	
			Abstract: In process industries, the availability of large volumes of data is not directly related to the extraction of valuable information or process monitoring with good performance. Usually, data is directly visualized as tables or tendency graphics, being not used properly. This paper presents the design of process monitoring by considering the design of alarms visualization plots which provides useful information in a unique plot, combined with soft sensor design used for the prediction of critical variables which defines the process operational performance. Examples of two cases with real industrial data are provided the effectiveness and utility of these methods.	CL
		170	Mauricio Montanares, Sebastián Guajardo, Iván Aguilera and Nathalie Risso. Assessing Machine learning-based approaches for Silica concentration estimation in Iron Froth flotation	
			Abstract: In the mining industry, specifically in flotation processes, there is a great challenge associated to the noninvasive measure of contaminants and impurities, without relying on laboratory samples. Achieving predictions on contaminant levels has a high impact on quality insurance and can help technicians and engineers make adjustments in advance to improve the quality of the final product, and thus profits. In this paper, exploratory research is performed on the problem of silica concentrate estimation for iron ore froth flotation using machine learning techniques, with the goal to identify algorithms that may be suitable for industry soft sensor development. For this purpose, a public, real process dataset is used and three different machine learning techniques are implemented: Random Forest (RF), Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU). The techniques were implemented, tested and compared in terms of their error percentage, mean absolute error, mean square error, and root mean square error. Obtained results show acceptable performance for LTSM and GRU implementations, being LSTM network the out-performer with errors below 9%.	CL
2		171	Fernando Antonio Castillo, Luis Arias, Hugo Garces and Alejandro Rojas. Turbulent Flame Monitoring Using Spectral Estimation Techniques	
			Abstract: A flame emits energy over a wide spectral region, and its associated spectra contain both continuous and discontinuous components, closely related to the combustion process current state. However, the non-linear and turbulent nature of the flame, high dimensionality of the spectral data, and the overlap between continuous and discontinuous spectral emissions requires the use of complex method to obtain valuable information for combustion closed loop-control and optimization. This work analyzes the spectral emission of the flame emitted by LPG flames to compute high resolution spectra combining the Maloney-Wandell spectral recovery method and field information of flame images with low spectral resolution. Then, we obtain different variables such as the flame temperature (in K) and local radiance (in µW=cm2), performing a dynamic, spectral and spatial combustion diagnostics	CL
3		173	Diego Tapia, Broderick Crawford, Ricardo Soto, Wenceslao Palma, José Lemus-Romani, Felipe Cisternas-Caneo, Mauricio Castillo, Marcelo Becerra-Rozas and Sanjay Misra. Embedding Q-Learning in the selection of metaheuristic operators: The enhanced binary greywolf optimizer case	
			Abstract: In the different situations present in the industry, combinatorial problems are increasingly frequent. This paper presents the interaction of Metaheuristics and Machine Learning, specifically as Machine Learning can be a support to enhance Metaheuristics. The resolution of the Set Covering Problem is presented, using the Grey Wolf Optimizer and Sine CosineAlgorithm metaheuristics that have been improved by adding a Q-Learning technique for the selection of a DiscretizationScheme, using two-steps, intelligently choosing which transfer function to use and which binarization technique to apply in each iteration	CL, NG

	Friday	26	Track T86 Chair:	Room 4
#	Hora	Paper ID	Authors, title	Countries
1	17:30	178	Javier Larraguibel, Raúl Carrasco, Leonardo Banguera, Carolina Lagos, Claudia Durán and Luis Osorio-Valenzuela. Supply chain and logistics in pandemic	
			Abstract: This research work has the purpose of analyzing and proposing strategies that allow to face the complexities brought by the pandemic within a supply chain. Under the context of the Covid 19 pandemic, a scenario analysis is carried out to propose strategies adaptable to similar problems. It was identified that those companies that had prior planning to deal with eventualities managed to overcome the effects of the crisis with greater success. This work highlights the need for companies to know and incorporate strategies that allow sustainability in the long term..	EC, CL
2		193	Jaime Bustos, Jose Luis Toro, Sonia Salvo and Martha Ramirez-Valdivia. Modeling a surgical system in a Public Hospital in Chile	
			Abstract: The little opportunity in the care of patients awaiting surgery causes multiple and serious consequences for them, their family and relatives. Given the complexity of the hospital system, and specifically operating room systems, their current planning has ample space for productivity improvement. This work uses simulation modeling approach to build a valid model of the OR system in the public hospital of Puerto Montt-Chile. To describe the model, activity data from the ORs and waiting lists for the year 2017 is used (near 15,000 interventions, an initial waiting list of 6,500 patients, 15 ORs, 150 surgeons, four daily hourly periods and consideration of weekends] to model the operation of the system using statistical and probability techniques. The model is validated using more than a dozen of performance indicators making it adequate to represent the true dynamics of the system in a simulation study.	CL
3		200	Marco Ceccarelli, Loredana Sarmati and Vincenzo Ambrogi. A robotized hospital bed for COVID-19 patients in intensive care treatments	
			Abstract: Patients in bed for clinical situations and specially in COVI19 treatments need special assistance with suitable bed configuration motion both to help therapies and physical conditions. Hospital beds are designed to ensure static safe configuration of patients mostly in supine position with some motion capability in elevating trunk or legs. More capability is today requested for permitting bedded patients to avoid inconveniences up to damage and to facilitate therapy treatments and clinical conditions. A robotized design solution for hospital beds with movable segments is proposed for patients of COVID- 19 in intensive and sub-intensive care treatments.	IT

KEYNOTE SPEAKERS 1

IEEE IFAC ICA ACCA 2021

Monday 22, March 2021, Room 1, 14:45 – 16:15

"Cyber-social-technological-cognitive (CSTC) approach in ecosystems: trends and challenges".

Dra. Felisa Córdova

Graduated Electrical Engineer at the University of Santiago de Chile USACH. She obtained the Diplome d´Etudes Approfondis in Electronics and the degree of Docteur Ingénieur at the University of Paris XI, France. Actually, she is professor and Director of the School of Engineering at the Faculty of Engineering, University Finis Terrae UFT, Santiago, Chile.

Abstract

This lecture aims to provide an international forum to discuss the main ideas about cyber-social-technological-cognitive approach present in indifferent ecosystems. Nowadays, investments that promote disruptive technologies and digital transformation accompanied by advances in Industry 4.0 enable the development of intelligent and smart systems in different domains. The hyperspace allows the interconnection of multiple spaces of computers and networks which are interlinked with each other in cyber, social, technological and cognitive domains. The CTSC approach is present today in indifferent ecosystems. In this context, conceptual models and architectures that integrate relevant attributes present in hyperspace are discussed focusing in Smart Ports, Green Energy Systems, and Health and Wellness Systems. In the case of Smart Ports, the Fifth generation ports are automated and sensorized, intensive in the use of artificial intelligence tools, sensors, RFID radio frequency, differential GPS system, Internet of Things (IoT), data management for Big Data, among others. Moreover, Green energy system's cyber domain enables technologies and processes to operate seamlessly such as grid flexibility enabled by IoT, and digital networks; smart metering; and the new concept of energy consumer producer "prosumer". In the field of Health and Wellness Systems the pandemic has given a great opportunity to CSTC in the application of new methods, models, practices, and technologies such as Robotics, Virtual and Augmented Reality, Big Data, Artificial Intelligence, and Analytics. All of them have extraordinary potential in the field of medicine as it allows to analyze large volumes of data in order to predict, prevent or customize treatments in different pathologies. Today different open source data platforms and AI are used to track the spread of the disease. The role of the Internet of services (IoS) stands out as an ecosystem that takes over complex collaborative applications using interoperable resources across platforms and cloud storage. It also addresses advances in AI, neuroscience, and cognitive sciences that enable the development of Human Body Communication (HBC) and Human Information Processing (HIP) and open the door to multiple applications in the Internet of the People (IoP) domain.

Biosketch:

Graduated Electrical Engineer at the University of Santiago de Chile USACH. She obtained the Diplome d´Etudes Approfondis in Electronics and the degree of Docteur Ingénieur at the University of Paris XI, France. Actually, she is professor and Director of the School of Engineering at the Faculty of Engineering, University Finis Terrae UFT, Santiago, Chile. She was professor, Academic Vice Rector and Director of the Industrial Engineering Department, at the Faculty of Engineering, University of Santiago de Chile USACH. She was also Director of the Master of Science Engineering Program and Header of Management Area of the Industrial Engineering Department of, at the Faculty of Physical and Mathematical Sciences at University of Chile. Her main research interest is in Business Strategy, Operations Management, and Knowledge Management. She has participated in several national and international research projects in the fields of Robotics, AGV and Virtual Operation Systems in underground mining, also in ports. She has published many papers in conference proceedings and international indexed journals in the area of Robotics, Knowledge and Operation Management, and Neuromanagement. She has participated in the organization of Conferences (ACCA, LCA, LCR, SEPROSUL, ICPR, CESA). She was past-president of the Chilean Association of Automatic Control ACCA and she was national councilor, President of the Education Committee and past Vice President of the College of Engineers of Chile. She participated as an institutional accreditation evaluator at the CNA, Chile and the CEAB accreditation (Washington Accord) to engineering programs, Canada. She was member of the accreditation board and member of the Directory of Acredita CI.

Mechanism Design of robotic devices in treatments of COVID19 patients

Profesor PhD. Marco Ceccarelli

Marco Ceccarelli
LARM2: Laboratory of Robot Mechatronics, Università di Roma Torvergata, Italia (http://larmlaboratory.net)
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Abstract:
Patients in bed for clinical situations and specially in COVI19 treatments need special assistance in bed configuration motion both to help therapies and physical conditions. Hospital beds are designed to ensure static safe configuration of patients mostly in supine position with some motion capability in elevating trunk or legs. More capability is today requested for permitting bedded patients to avoid inconveniences up to damage and to facilitate therapy treatment and clinical conditions. Those aspect are discussed from engineering viewpoints once elaborated from medical requirements. Those backgrounds give inspiration for mechanism designs in robotized solutions that can be developed either in improvements of existing medical devices and/or in new service robotic systems for medical areas as for specific problems in treating the sanitarian situation against the COVID19 pandemics. Achievements can be developed and are under the current attention to support treatments of patients in COVID-19 pandemics. Mechanism design for such robotic systems and applications is discussed as essential part of service robotic systems with issues for safety, comfort, and user-oriented features within the special conditions and needs in COVID-19treatments. Examples are illustrated from direct experience of the author in developing a robotized improvement of hospital beds and in conceiving new robotic devices for motion assistance of limbs of bedded patients in intensive care treatments.
Keywords: Biomedical Engineering, Robotics, Medical Devices, COVID19

Bio sketch:
Marco Ceccarelli received his Ph.D. in Mechanical Engineering from La Sapienza, University of Rome, Italy, in 1988. He is Professor of Mechanics of Machines at the University of Rome Tor Vergata, Italy, where he chairs LARM2: Laboratory of Robot Mechatronics.
His research interests cover subjects of robot design, mechanism kinematics, experimental mechanics with special attention to parallel kinematic machines, service robotic devices, mechanism design, and history of machines and mechanisms with an expertise that is documented by several published papers not only in the fields of Robotics. He has been visiting professor in several universities in the world. He is ASME fellow. Professor Ceccarelli serves in several Journal editorial boards and conference scientific committees. He is editor of the Springer book series on Mechanism and Machine Science (MMS) and History of MMS. Professor Ceccarelli is the Past President of IFToMM, the International Federation for the Promotion of MMS. He has started several international conferences including MEDER (Mechanism Design for Robotics) and MUSME (Multibody Systems and Mechatronics).

KEYNOTE SPEAKERS 3

IEEE IFAC ICA ACCA 2021

Monday 22, March 2021, Room 3, 14:45 – 16:15

Renewable Energy and Forest Conservation

The role of empowering young rural and indigenous girls to become agents of change.

Raquel Fratta, MPA

Raquel Fratta MPA
She holds a Master's degree in Public Administration from the University of East Tennessee State University, a Bachelor's degree in International Studies from Old Dominion University in Virginia, United States, and a Certificate in Sustainable Development and Environmental Conservation from Queensland University in Australia.

Abstract:

The Mbaracayu Nature Forest Reserve is one of the last remnants of primary forest in Paraguay with one of the greatest biodiversity of the country given its flora, fauna, and rich indigenous culture. Located in the eastern region of the country, in the department of Canindeyu, it covers a territory of 64,406 hectares - seven times the size of Asunción. The Mbaracayu Reserve represents the Atlantic Forest and the Cerrado, two ecosystems of high importance for conservation which only about 7% of its original area persists in the present. This site was recognized by the UNESCO as the core area to the Mbaracayu Biosphere Reserve, the first one in Paraguay.

Inside this natural protected area, The Mbaracayu Educational Center was established as a boarding school for young rural and indigenous girls from the ages of 15 to 18 as a conservation strategy with a powerful mission: to promote the transformation of young rural and indigenous girls to become agents of change. Both, the Mbaracayu Nature Forest Reserve and the Mbaracayu Educational Center were established and are still managed by Fundación Moisés Bertoni, a local NGO.

In 2018, the school won the Zayed Sustainability Prize to implement a project focusing on the provision of renewable energy, energy efficiency, sustainability and community strengthening.

The presentation describes the implementation of this project, starting with the forest conservation model, the school, and moving on the state-of-the-art technology installed in the middle of the forest, referring to hybrid solar panels which provides both hot water and electricity and other components of the project. It also highlights the role of empowering young rural and indigenous girls to become agents of change, including a bilingual children's book for all ages entitled ''Sustainable Adventures in Mbaracayu" as a celebration to innovation, diversity, and a call to action.

Short Bio:

She holds a Master's degree in Public Administration from the University of East Tennessee State University, a Bachelor's degree in International Studies from Old Dominion University in Virginia, United States, and a Certificate in Sustainable Development and Environmental Conservation from Queensland University in Australia.

She leads the area of Initiatives for the New Economy at Fundación Moisés Bertoni, an NGO in Paraguay dedicated to nature conservation and sustainability. She focuses on the design and implementation of innovative projects ranging from: renewable energy, STEM in education, young women's empowerment and initiatives that focus on triple bottom line: economic, social and environmental value.

She collaborates closely with the government, the private sector and international organizations such as the World Bank, the IDB Group in areas including: social environmental justice, circular economy, and development among others.

She is a board member of the Paraguayan Association of Professionals Graduated in the U.S. (APPG) and she serves as a Committee member at the World Environmental Congress (WEEC) based in Italy.

KEYNOTE SPEAKERS 4

IEEE IFAC ICA ACCA 2021

Wennesday 24, March 2021, Room 2, 14:15 – 16:15

Transportation Electrification in a Post Covid-19 World

Prof. Pat Wheeler

Prof Pat Wheeler
received his BEng [Hons] degree in 1990 from the University of Bristol, UK. He received his PhD degree in Electrical Engineering for his work on Matrix Converters from the University of Bristol, UK in 1994. In 1993 he moved to the University of Nottingham and worked as a research assistant in the Department of Electrical and Electronic Engineering

Abstract:
This plenary presentation will consider the roadmaps for transportation electrification across a variety of platforms and the technological developments which are going to be needed to make these visions possible. These developments will include the electrical drivetrain design and the applications of motor design and power converter topology choices as well as the impact of emerging technology advances including cooling techniques, integration, system optimisation and wide-bandgap semiconductors. Transport platforms discussed will include the requirements for automotive (cars), motorbikes and aeroplanes.

Biosketch:

Prof Pat Wheeler received his BEng [Hons] degree in 1990 from the University of Bristol, UK. He received his PhD degree in Electrical Engineering for his work on Matrix Converters from the University of Bristol, UK in 1994. In 1993 he moved to the University of Nottingham and worked as a research assistant in the Department of Electrical and Electronic Engineering. In 1996 he became a Lecturer in the Power Electronics, Machines and Control Group at the University of Nottingham, UK. Since January 2008 he has been a Full Professor in the same research group.

He was Head of the Department of Electrical and Electronic Engineering at the University of Nottingham from 2015 to 2018. He is currently the Head of the Power Electronics, Machines and Control Research Group, Global Director of the University of Nottingham's Institute of Aerosapce Technology and was the Li Dak Sum Chair Professor in Electrical and Aerospace Engineering. He is a member of the IEEE PELs AdCom and is currently an IEEE PELS Vice-President. He has published over 750 academic publications in leading international conferences and journals.

Wennesday 24, March 2021, Room 1, 14:15 – 16:15

Precision Planetary Landing with Hazard Detection and Avoidance

Dr. Robert H. Bishop

Dr. Robert H. Bishop, P.E.
is the Dean of Engineering and the Founder, President & CEO of the Institute of Applied Engineering at the University of South Florida where he holds a full professor position in the Department of Electrical Engineering. Prior to academia, he was a member of the technical staff at the Charles Stark Draper Laboratory.

Abstract:
The navigation filter architecture successfully deployed on the Morpheus flight vehicle is discussed. The filter was developed as a key element of the NASA Autonomous Landing and Hazard Avoidance Technology project and over the course of 15 successful free fights was integrated into the Morpheus vehicle, operations, and flight control loop. Flight testing demonstrated autonomous hazard detection and avoidance employing an onboard dual-state inertial estimator Kalman filter software by landing within 2 meters of the desired safe landing site target. The main new contribution is the incorporation of a sophisticated hazard relative navigation sensor--originally intended to locate safe landing sites--into the navigation system and employed as a navigation sensor. Issues that remain to be resolved and will be discussed are centered on merging smart sensors that aim to minimize change in relative state estimation errors to a target landing site rather than the more typical navigation sensors and algorithms that aim to reduce inertial state estimation errors.

Short Bio:
Dr. Robert H. Bishop, P.E. is the Dean of Engineering and the Founder, President & CEO of the Institute of Applied Engineering at the University of South Florida where he holds a full professor position in the Department of Electrical Engineering. Prior to academia, he was a member of the technical staff at the Charles Stark Draper Laboratory. As an active researcher and scholar, Dr. Bishop is a specialist in the area of systems theory, guidance and control of spacecraft, and navigation and estimation theory with applications across a broad range of aerospace challenges. He co-authors one of the world's leading textbooks in control theory, and has authored two other textbooks, edited two handbooks, and authored/co-authored over one hundred and forty-five journal and conference papers. Dr. Bishop received his PhD from Rice University in Electrical & Computer Engineering. He is a member of the Academia Panamericana de Ingenieria, a Fellow of the American Institute of Aeronautics and Astronautics, Fellow of the American Astronautical Association, and Fellow of the American Association for the Advancement of Science.

DISCUSSION PANEL

IEEE IFAC ICA ACCA 2021

Wennesday 24, March 2021, Room 3, 14:15 – 16:15

"Panel on technological developments for pandemic treatment"

Moderator: Víctor Grimblatt.

Panelists:
Marco Ceccarelli, Universidad de Roma, Italy,
Enrique Germany, Universidad de Concepción, Chile
Felipe Lechuga Pontificia Universidad Católica de Chile,

Biosketches:

Víctor Grimblatt:
He has an engineering diploma in microelectronics from Institut Nationale Polytechnique de Grenoble (INPG – France) and an electronic engineering diploma from Universidad Tecnica Federico Santa Maria (Chile). He is doing his PhD on IoT for Smart Agriculture at IMS lab, University of Bordeaux. He is currently R&D Group Director and General Manager of Synopsys Chile. He has expertise and knowledge in business and technology and understands very well the trends of the electronic industry; therefore, he is often consulted for new technological business development. He has published several papers in IoT, EDA and embedded systems development, and since 2007 he has been invited to several Latin American Conferences (Argentina, Brazil, Chile, Mexico, Peru and Uruguay) to talk about Circuit Design, EDA, IoT, and Embedded Systems. Since 2012 he is chair of the IEEE Chilean chapter of the CASS. He is also the President of the Chilean Electronic and Electrical Industry Association (AIE). He has been part of several conferences TCP (ISCAS, ICECS, LASCAS) and is chairing the EDA and Circuit design Sub-Committee for ICECS. He is also is Program Co-Chair of FoodCAS. Since 2018 he is Chair of LASCAS Steering Committee.

Marco Ceccarelli received his Ph.D. in Mechanical Engineering from La Sapienza, University of Rome, Italy, in 1988. He is Professor of Mechanics of Machines at the University of Rome Tor Vergata, Italy, where he chairs LARM2: Laboratory of Robot Mechatronics.His research interests cover subjects of robot design, mechanism kinematics, experimental mechanics with special attention to parallel kinematic machines, service robotic devices, mechanism design, and history of machines and mechanisms with an expertise that is documented by several published papers not only in the fields of Robotics.

Enrique Germany:
Es Ingeniero Civil Biomédico, Magister y Doctor en Ciencias de la Ingeniería Eléctrica de la Universidad de Concepción. Cuenta con experiencia en desarrollo de sistemas electrónicos embebidos e interfaces humano-computador mediante adquisición y procesamiento de bio-potenciales. Enrique se desempeña como docente part-time para pregrado ingeniería en la UdeC donde dicta clases de Sistemas Embebidos basados en micro-controladores, además de desempeñarse como ingeniero líder de desarrollo electrónico en proyectos del Centro para la Industria 4.0 (C4I). Enrique ha sido miembro activo del IEEE y las sociedades IEEE Engineering in Medicine and Biology Society, Life Sciences Community, IEEE y IEEE Industry Applications Society Membership por 9 años, participando de conferencias nacionales e internacionales y promoviendo el continuo crecimiento del capitulo IEEE EMBS de estudiantes CICB Concepción de la Universidad de Concepción.

Felipe Lechuga
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