@icsc18
#ICSC18

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

7th International Conference on

Systems and Control

ICSC'18 October 24 – 26, 2018. Valencia (Spain)

Sponsors

industrials valència
ESCOLA TÈCNICA SUPERIOR ENGINYERS INDUSTRIALS UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Escuela Técnica Superior de Ingeniería del Diseño

etsinf
Escuela Técnica Superior de Ingeniería Informática

isa departamento de ingeniería de sistemas y automática

Technical Co-Sponsors

IEEE

ai2 INSTITUTO DE AUTOMÁTICA E INFORMÁTICA INDUSTRIAL

CSS IEEE CONTROL SYSTEMS SOCIETY

7th International Conference on
Systems and Control

ICSC'18 - October 24 - 26, 2018. Valencia (Spain)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

General Program

@icsc18
#ICSC18

October, 24th 2018

3:30 pm – 4:00 pm	**Registration**
4:00 pm – 4:30 pm	**Opening Ceremony**
4:30 pm – 5:30 pm	**Plenary Session** *Controlling the impact of external perturbations in Floating Offshore Wind Turbines.* (M. Tomás & Prof. M. Santos)
5:30 pm – 6:00 pm	**Coffee Break**
6:00 pm – 7:00 pm	**Plenary Session** *Network Analysis, Data Sciences and Control in Computational Analysis.* (Prof. Panos M. Pardalos)
8:00 pm – 9:30 pm	**Welcome Reception** *At Restaurante Galileo-Galilei. UPV.*

October, 25th 2018

8:30 am – 10:30 am	**Regular Session**
10:30 am – 11:00 am	**Coffee Break**
11:00 am – 1:00 pm	**Regular Session**
1:00 pm – 2:00 pm	**Lunch**
6:30 pm – 11:30 pm	**Social Event & Gala Dinner** *Boat trip on "La Albufera" and dinner at Restaurante Nou Racó.*

October, 26th 2018

9:00 am – 11:00 am	**Regular Session**
11:00 am – 11:30 am	**Coffee Break**
11:30 am – 12:15 pm	**Plenary Session** *Sampled-data and Networked Control Systems: A Time-Delay Approach.* (Prof. E, Fridman)
12:15 pm – 1:00 pm	**Plenary Session** *Vibration control systems with information constraints.* (Prof H. Karimi Reza)
1:00 pm – 1:30 pm	**Closing Ceremony**
1:30 pm	**Lunch**

7th International Conference on
Systems and Control
ICSC'18 - October 24 - 26, 2018. Valencia (Spain)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

@icsc18
#ICSC18

October, 24th 2018

3:30 pm - 4:00 pm	**Registration**
4:00 pm - 4:30 pm	**Opening Ceremony**
4:30 pm - 5:30 pm	**Plenary Session (WeAA)** *Controlling the impact of external perturbations in Floating Offshore Wind Turbines.* BY: María Tomás Rodriguez and Matilde Santos Peñas ROOM: Assembly Hall Nexus Building (ground floor)
5:30 pm - 6:00 pm	**Coffee Break**
6:00 pm - 19:00 pm	**Plenary Session (WeBA)** *Network Analysis, Data Sciences and Control in Computational Analysis* BY: Panos M. Pardalos ROOM: Assembly Hall Nexus Building (ground floor)
8:00 pm - 9:30 pm	**Welcome Reception** *At Restaurante Galileo-Galilei. UPV.*

7th International Conference on
Systems and Control
ICSC'18 - October 24 - 26, 2018. Valencia (Spain)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

@icsc18
#ICSC18

October, 25th 2018

8:30 am - 10:30 am — Regular session

Regular Session (**ThAA**) ***Robust and Multivariable Control*** ROOM 2.10	Regular Session (**ThAB**) ***Fault Detection and Diagnostics*** ROOM 2.11
Regular Session (**ThAC**) ***Optimization*** ROOM 2.12	Regular Session (**ThAD**) ***Anutonomous System*** ROOM 2.13

10:30 am- 11:00 am — Coffee Break

11:00 pm- 1:00 pm — Regular session

Regular Session (**ThBA**) ***Renewable Energy and Power Systems*** ROOM 2.10	Regular Session (**ThBB**) ***Control Applications I*** ROOM 2.11
Regular Session (**ThBC**) ***Renewable Energy*** ROOM 2.12	Regular Session (**ThBD**) ***Robust Control and Hinfty Control*** ROOM 2.13

1:00 pm - 2:00 pm — Lunch

6:30 pm - 11:30 pm — Social Event & Gala Dinner

Boat trip on "La Albufera" and dinner at Restaurante Nou Racó.

7th International Conference on
Systems and Control
ICSC'18 - October 24 - 26, 2018. Valencia (Spain)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

@icsc18
#ICSC18

October, 26th 2018

9:00 am - 11:00 am	**Regular session** Regular Session (**FrAA**) ***Control Algorithms Implementation*** ROOM 2.10 Regular Session (**FrAB**) ***Control Applications II*** ROOM 2.11 Regular Session (**FrAC**) ***Estimations and Identification*** ROOM 2.12 Regular Session (**FrAD**) ***Modelling of Complex Systems*** ROOM 2.13
11:00 am - 11:30 am	**Coffee Break**
11:30 am - 12:15 am	**Plenary Session (FrBA)** *Sampled-Data and Networked Control Systems: A Time-Delay Approach.* BY: Emilia Fridman ROOM: Assembly Hall Nexus Building (ground floor)
12:15 am - 1:00 pm	**Plenary Session (FrBA)** *Vibration Control Systems with Information Constraints.* BY: Hamid Reza Karimi ROOM: Assembly Hall Nexus Building (ground floor)
1:00 pm - 1:30 pm	**Closing Ceremony**
1:30 pm	**Lunch**

7th International Conference on
Systems and Control
ICSC'18 - October 24 - 26, 2018. Valencia (Spain)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

2018 7th International Conference on Systems and Control

October 24 – 26, 2018. Valencia, Spain

- Book of Abstracts –

Program at a Glance

Abstracts sessions Wednesday, 24th

Abstracts sessions Thusrday, 25th

Abstracts sessions Friday, 26th

ICSC 2018 Technical Program Wednesday October 24, 2018

Plenaries
16:30-17:30 WeAA Assembly Hall Nexus Building (ground floor) Plenary Session I

18:00-19:00 WeBA Assembly Hall Nexus Building (ground floor) Plenary Session II

ICSC 2018 Technical Program Thursday October 25, 2018

1	2	3	4
08:30-10:30 ThAA Room 2.10, Nexus building (second floor) Robust and Multivariable Control	08:30-10:30 ThAB Room 2.11, Nexus building (second floor) Fault Detection and Diagnostics	08:30-10:30 ThAC Room 2.12, Nexus building (second floor) Optimization	08:30-10:30 ThAD Room 2.13, Nexus building (second floor) Autonomous System
11:00-13:20 ThBA Room 2.10, Nexus building (second floor) Renewable Energy and Power Systems	11:00-13:20 ThBB Room 2.11, Nexus building (second floor) Control Applications I	11:00-13:20 ThBC Room 2.12, Nexus building (second floor) Renewable Energy	11:00-13:20 ThBD Room 2.13, Nexus building (second floor) Robust Control and Hinfty Control

ICSC 2018 Technical Program Friday October 26, 2018

1	2	3	4
09:00-11:00 FrAA Room 2.10, Nexus building (second floor) Control Algorithms Implementation	09:00-11:00 FrAB Room 2.11, Nexus building (second floor) Control Applications II	09:00-11:00 FrAC Room 2.12, Nexus building (second floor) Estimations and Identification	09:00-11:00 FrAD Room 2.13, Nexus building (second floor) Modelling of Complexe Systems

11:30-12:15 FrBA Assembly Hall Nexus Building (ground floor) Plenary Session III
12:15-13:00 FrCA Assembly Hall Nexus Building (ground floor) Plenary Session IV

Technical Program for Wednesday October 24, 2018

WeAA	Assembly Hall Nexus Building (ground floor)
Plenary Session I	

16:30-17:30 WeAA.1

Controlling the impact of external perturbations in Floating Offshore Wind Turbines

María Tomás-Rodriguez, Senior Lecturer,
School of Mathematics, Computer Science & Engineering. The City University of London (UK)

Matilde Santos Peñas, Professor,
Department of Computer Architecture and Systems Engineering. Universidad Complutense de Madrid

Abstract:

Worldwide and within the renewable energies field, eolic energy is raising expectations in terms of high efficiency energetic production but still considered to produce a relatively important environmental impact when the wind turbines are located onshore. One possible solution to the potential onshore hazards is the installation of offshore wind turbines (OWT), as they are promising in terms of energetic production due to the proximity of the eolic resources to the coastal energy loadings.

Up to these days, most of the offshore wind farms consist of fixed bottom structures being these suitable in shallow waters but not economically worthy in deep waters. In the last years there have been already research and engineering efforts in Floating Offshore Wind Turbines, (FOWT) that can be installed in areas of deep seabed. For these types of structures to be economically efficient, they should safely withstand surrounding adverse conditions such as high-speed winds, strong currents and large waves. Unwanted oscillations, heavy loads and structure's fatigue represent a need for more maintenance, less efficiency hours, costly components and potential failures. Clearly, from an engineering/ control systems point of view these poses a difficult challenge.

FOWT present unstable nonlinear dynamics and their study through modelling and simulations is necessary as well as the study of all the mentioned possible perturbations that may affect the system's behaviour and efficiency. It is therefore, necessary to include all these factors in the models to be studied, analysed and compensated through control methods with the objective of increasing the reliability, optimize the energetic production and allow for lighter and cheaper structures.

In this conference, the current existing FOWT challenges will be presented as well as possible solutions for controlling the impact of the external perturbations.

WeBA	Assembly Hall Nexus Building (ground floor)
Plenary Session II	

18:00-19:00 WeBA.1

Network Analysis, Data Sciences and Control in Computational NeuroScience

Prof. Panos M. Pardalos,
Center for Applied Optimization, ISE Department. University of Florida

Abstract:

The human brain is probably one of the most complex objects in nature. In recent years many network models have been proposed to analyze brain dynamics and study certain neurological disorders.

In nearly every study conducted on human brain networks the questions asked were what are the hubs of the network, e.g. the nodes with highest degree?

There is however another important network characteristic set of nodes, arising from network controllability theory, which for the time being remained beyond the attention of researchers: identify a minimum set of driver nodes, providing controllability of the network.

In this talk we are going to discuss a spectrum of problems in computational neuroscience, whose solution needs tools from data sciences and control.

Technical Program for Thursday October 25, 2018

ThAA	Room 2.10, Nexus building (second floor)
Robust and Multivariable Control (Regular Session)	

08:30-08:50 ThAA.1

Smooth 3D Path Planning for Non-Holonomic UAVs

Vanegas, Gloria Isabel — Univ. Pol. De València
Samaniego, Franklin Eduardo — Univ. Pol. De València
Girbés, Vicent — Univ. Pol. De València
Armesto, Leopoldo — None
Garcia-Nieto, Sergio — Univ. Pol. De Valencia

This paper presents a path planning approach for Unmanned Aerial Vehicles (UAVs) with non-holonomic constraints, such as fixed-wing airplanes. The control scheme is divided in two stages: local planner and kinematic control. In the planning stage, a smooth curve is generated in 3D Euclidean space, using 3D clothoids approximated by Rational Bézier curves. Then, in a second stage, the

autonomous flying vehicle is piloted to track references of velocity and orientation. Real flight simulation tests have been carried out to observe the behaviour of the UAV when following 3D clothoids, in order to analyze the properties and benefits of using such smooth curves for path planning of fixed-wing planes.

08:50-09:10 ThAA.2

Multivariable Controller for Stationary Flat Plate Solar Collectors

Tosi, Andrea — Univ. of Brescia
Roca, Lidia — Psa - Ciemat
Gil, Juan Diego — Univ. of Almería
Visioli, Antonio — Univ. of Brescia
Berenguel, Manuel — Univ. of Almeria

The water flow rate control, which is the principal control loop required to operate stationary solar fields, can be as simple as designing a PID controller for a unique pump whose behavior can be approximated by a first-order system with delay. Nevertheless, when the water flow rate is manipulated with multiple actuators (pumps or valves), the problem presents some challenges due to hydraulic interactions. This paper presents a multivariable controller scheme to deal with the control of a solar field with five pumping systems. Simulation and experimental results are included to demonstrate the effectiveness of the proposed controller.

09:10-09:30 ThAA.3

Comparative Study of 3-Dimensional Path Planning Methods Constrained by the Maneuverability of Unmanned Aerial Vehicles

Samaniego, Franklin Eduardo — Univ. Pol. De València
Sanchis, Javier — Pol. Univ. of Valencia
Garcia-Nieto, Sergio — Univ. Pol. De Valencia
Simarro, Raul — Univ. Pol. De València

This paper presents a comparison of two classic path planning techniques, Rapidly-Exploring Random Tree and Modified Adaptive Cell Decomposition applied to 3-Dimensional space path planning generation for UAVs. The study presented focuses on the inclusion of real fixed-wing UAVs maneuverability, where the dynamic and kinematic behaviour introduces hard constraints in real environments. In addition, the inclusion of Dubins and Clotoids curves in 3-Dimensional spaces has been considered in terms of improving the results of these classical methods. Flight simulation results have been included to clarify this comparative study.

09:30-09:50 ThAA.4

On the P-D State Feedback Controller Design for the Common Triangular Decoupling of Multi Model Descriptor Systems

KOUMBOULIS, FOTIOS — Tech. Education Inst. of Sterea Ellada

The problem of common Triangular Decoupling for multi model descriptor linear systems, via regular Proportional plus Derivative (P-D) state feedback controllers, is solved. The necessary and sufficient conditions for the solvability of the problem are established. The analytic expressions of the general solution of the P-D state feedback controllers and the general solutions of the multi model triangularly decoupled closed transfer matrices are derived.

09:50-10:10 ThAA.5

Static Output Feedback Control with H∞ Performance for 2-D Discrete Systems in Roesser Model

Badie, Khalid — Khalid.badie@usmba.ac.ma
Alfidi, Mohamed — Faculte Des Sciences Dhar Mehrez
Tadeo, Fernando — Univ. of Valladolid
Chalh, Zakaria — National School of Applied Sciences

This paper revisits the problem of H_∞ static output feedback control of two-dimensional (2-D) discrete systems described by the Roesser model. Based on a Bounded Real Lemma of 2-D Roesser Model and Finsler's Lemma, a new sufficient condition for H_∞ performance analysis of the closed-loop system is first derived, and then the static output feedback controller is obtained such that the closed-loop system is asymptotically stable with a guaranteed H_∞ disturbance attenuation level. All results are developed in terms of linear matrix inequalitiy (LMI). Finally a numerical example is given to show the effectiveness of the proposed method.

10:10-10:30 ThAA.6

Fault Detection for Uncertain Switched Systems with Time-Varying State Delay

Benzaouia, Abdellah — Faculty of Science Semlalia
Telbissi, Kenza — Univ. Cadi Ayyad

This paper discusses the problem of fault detection for discrete-time switched systems with time-varying state delay by using a novel switched lyapunov functional. Sufficient condition of constructing an observer is achieved. This obtained condition is formulated to obtain a new reduced size LMI with slack matrix variable. A simulation example is given to validate and compare the proposed result.

ThAB Room 2.11, Nexus building (second floor)

Fault Detection and Diagnostics (Regular Session)

08:30-08:50 ThAB.1

Stabilization and Fault Detection for Takagi-Sugeno System Application to a Bioreactor

BOUAKOU, MOHAMMED Cadi Ayyad Univ. Faculty of Sciences Marrakesh
Channa, Rafik Cadi Ayyad Univ. Faculty of Sciences Marrakesh

In this paper, a general approach to design stabilization and fault detection with residual generators for non-linear systems described by a Takagi-Sugeno model is presented. The first step consists on the presentation of the process and introduction of T-S representation for non-linear systems. In the second part of this work, it was presented the problem of the design fault detection. The principle of the proposed strategy is to transform the problem of simultaneously minimizing the perturbation effect and maximizing the fault effect, on the residual vector, in a simple problem of L2-norm minimization.

08:50-09:10 ThAB.2

Unknown Input Observer Design for Faults Estimation Using Linear Parameter Varying Model. Application to Wind Turbine Systems

Li, Shanzhi Nanjing Univ. of Science and Tech
WANG, Haoping Nanjing Univ. of Science and Tech
Aitouche, Abdel CRISTAL/HEI
Christov, Nicolaï Univ. Des Sciences Et Tech. De Lille

—This paper proposes a sensor and actuator estimation algorithm based on linear parameter varying (LPV) model. Considering sensor noise and disturbance, an unknown input observer (UIO) is developed. In this scheme, by building an augmented system with a filter, sensor fault and noise of the original system become into a part of actuator fault and disturbance. According to this augmented system, an UIO and fault estimation method have been designed. Then, by solving the linear matrix equalities (LMEs) and the linear matrix inequalities (LMIs), the parameters of the UIO are obtained. In addition, we analyze the convergence of the observer. In order to verify the proposed method, a wind turbine system with torque actuator fault and pitch angle sensor fault has been tested. From simulation results, it presents an efficient performance on both state and fault estimation.

09:10-09:30 ThAB.3

Enhanced Kalman Filter through Modified Empirical Mode Decomposition for Wind Profile Exogenous Disturbance Extraction & Isolation in Wind Turbines

Salameh, Jack Univ. De Poitiers
Cauet, Sebastien Univ. of Poitiers
etien, erik Univ. of Poitiers
Sakout, Anas Univ. De La Rochelle
Rambault, Laurent E.s.i.p

Wind profile variations and disturbances are the main cause for stress and fatigue for wind turbines. These disturbances propagate along the drive train, through the gearbox and into the generator resulting in current and voltage output fluctuations. The wind profile is a non-stationary random process, thus the resulting vibrations and disturbances throughout the system are non-stationary. Classical traditional frequency-domain analysis techniques fall short when dealing with this type of signals. Modern analysis and control requirements in wind turbines justify the need for advanced techniques to cope with the non-stationary nature of measured signals. Compensating these disturbances to protect different wind turbine components, while detecting harmonics caused by these disturbances, render the turbine system operation smoother while increasing reliability, efficiency and robustness. This paper applies a Kalman filter based method for signal reconstruction through harmonic estimation for the turbine side angular velocity. In addition, a new modified Empirical Mode Decomposition (EMD) approach is introduced capable of separating the continuous component of a non-stationary signal from its added high and low frequency waves. The EMD intends to isolate harmonics from the carrier wave in the angular velocity signal for analysis. Then the EMD and the Kalman filter are combined in order to improve individual harmonic component estimation while allowing the use of conventional signal processing techniques. The method can be used either to reject wind profile disturbances, or detect added fault signatures by a component.

09:30-09:50 ThAB.4

H_/H_infty Fault Detection Proportional Integral Observer for Uncertain T-S Fuzzy Systems

MAKNI, Salama ENIG
Bouattour, Maha National Engineering School of Sfax
El hajjaji, ahmed Univ. of Picardie Jules Verne
Chaabane, Mohamed National Engineering School of Sfax, Tunisia
Bosche, Jerome Univ. of Picardie Jules Verne

In this work, we investigate the detection and estimation problems of Sensor and Actuator Faults (SAF) for uncertain nonlinear systems represented by Takagi-Sugeno (TS) fuzzy models subject to an Unknown Bounded Disturbance (UBD). For this, we design a Proportional Integral (PI) observer to estimate state and both sensor and actuator fault vectors, simultaneously. To maximize the fault detection and to minimize the disturbance effects, we consider the H_/H_infty multiobjective performances. By solving a set of Linear Matrix Inequalities (LMIs) and using Lyapunov theory, we prove the existence of this observer and we guarantee the convergence of both the state estimation errors and fault estimation errors. The descriptor formulation is used to get relaxed LMIs. Finally, a numerical example and simulation results are illustrated to prove the mentioned process efficiency.

09:50-10:10 ThAB.5

Diagnosis of a Permanent Magnet Synchronous Generator Using the Extended Kalman Filter and the Fast Fourier Transform

Gliga, Lavinius Ioan "Pol. Univ. of Bucharest, Faculty of Automatic Cont
Chafouk, Houcine Irseem / Esigelec

Popescu, Dumitru — Pol. Univ. of Bucharest
Lupu, Ciprian — Pol. Univ. of Bucharest

The most common faults which can affect a Permanent Magnet Synchronous Generator are the rotor demagnetization, eccentricity (static, dynamic and mixed) and inter-turn short circuit. Their effect is noticeable on the spectrum of the stator currents, which is computed using the FFT. However, for a wind turbine, the spectrum of the currents changes with the wind speed. Therefore, the obtained results may not be accurate. In this paper, the residuals between an Extended Kalman Filter and the measured currents are proposed to be used for fault diagnosis and identification, via the FFT. The spectrum of the residuals is invariant to changes in the wind speed, but sensitive to faults.

10:10-10:30 ThAB.6

Fault Sensor Detection and Estimation Based on LPV Observer for Vehicle Lateral Dynamics

ALARIDH, IBRAHIM — Univ. of Lille
Aitouche, Abdel — CRISTAL/HEI
Zemouche, Ali — Univ. of Lorraine

This paper deals with a fault sensor detection and estimation based on Unknown Input Observer (UIO) for vehicle lateral dynamics. The vehicle lateral dynamics is represented by a fourth degree of freedom model. This nonlinear model is transformed into linear parameter varying model where the longitudinal velocity is considered as parameter varying. Then, an Unknown Input Observer is designed in order to reconstruct the state variables in presence of sensor faults. Based on Lyapunov theory, the observer gains are computed by Linear Matrix Inequalities. The approach can discriminate sensor faults from disturbances. Simulation results are given to show the effectiveness of the proposed approach to detect sensor faults subject to disturbances.

ThAC Room 2.12, Nexus building (second floor)

Optimization (Regular Session)

08:30-08:50 ThAC.1

Tuning DMC Controller Using Multi-Objective Optimization for the CIC2018 Benchmark Challenge

Babiera, Carlos — Univ. Pol. De València

Herrero Durá, Juan Manuel — Pol. Univ. of Valencia

Sanchis, Javier — Pol. Univ. of Valencia

Blasco, Xavier — Univ. Pol. De Valencia

In this paper, a multivariable Dynamic Matrix Control (DMC) tuning using multi-objective optimization (MO) is presented and evaluated on the one-staged refrigeration cycle model described in the CIC2018 benchmark challenge – an adaptation of the benchmark proposed in the PID18 Conference. The MO approach takes advantage of the relative indexes given by the benchmark, allowing knowledge about how much the DMC parameters influence control performance. Results of the MO approach are shown using Level Diagrams (LD), a tool for visualization and analysis of multidimensional Pareto fronts. Consequently, different DMC tunings are selected for different trade-offs between the relative indexes. Selection procedure shows how relevant an analysis of the Pareto Front can be in the decision-making stage for multivariable controller tuning.

08:50-09:10 ThAC.2

Modifier Adaptation Using Transient Measurements to Compute Plant Gradients

Rodriguez-Blanco, Tania — Univ. of Valladolid

Sarabia, Daniel — Univ. of Burgos

de Prada, Cesar — Univ. of Valladolid

Traditionally, Modifier-Adaptation (MA) proceeds by iteratively adjusting the optimization problem with modifiers calculated from steady-state information obtained after each real-time optimization (RTO) execution. This implies a long convergence time. This paper presents one approach to speed up the convergence to the optimum by using transient information of the process. This technique is based on a recursive identification algorithm to estimate process gradients from transient measurements, achieving the plant optimum faster than traditional MA techniques. The method has been implemented in the operation of a depropanizer distillation column in order to show its advantages.

09:10-09:30 ThAC.3

Algorithms for the Estimation of the Region of Attraction with Positively Invariant Sets

Iannelli, Andrea — Univ. of Bristol

Marcos, Andres — Univ. of Bristol

Lowenberg, Mark — Univ. of Bristol

This article focuses on the numerical estimation of the Region of Attraction of systems with polynomial vector field. The presented approach, based on a recent theoretical work on positively invariant sets, computes the inner Estimates of the Region of Attraction by means of Sum of Squares techniques. This allows the set containment conditions defining the region to be enforced at the expense of requiring iterative schemes since the ensuing optimization features bilinearities in the decision variables. The main contribution consists of two novel algorithms aimed at addressing some of the shortcomings typically associated with the adoption of iterative schemes. The results confirm the advantages of the proposed approaches, particularly as the size of the system increases.

09:30-09:50 ThAC.4

Design and Control of Standalone Wind Powered Water Pumping System

BENZAOUIA, Soufyane — LGEM - Univ. Mohamed Premier - Oujda / MIS - Univ. De

RABHI, ABDELHAMID — MIS

ZOUGGAR, Smail — Univ. Mohammed First Oujda, Maroc

El Hajjaji, Ahmed — Univ. De Picardie-Jules Verne

This paper describe and investigate the performances of a new wind electric water pumping system configuration. The proposed system comprises of a wind turbine, a permanent magnet synchronous generator, an AC/DC converter, a DC/DC boost converter in the case of using a control strategy, a permanent-magnet DC motor and a centrifugal pump. First of all, the transient responses of the direct coupling system caused by sudden wind speed change have been investigated. Thereafter, the pumping system characteristics have been determined and it is shown that the system can be optimized compared to the direct coupling system. Two MPPT controllers based on Perturb & Observe and Fuzzy Logic have been tested and applied on the studied system in order to determine the appropriate MPPT algorithm. Simulation results verify the effectiveness of the proposed system and control algorithm.

09:50-10:10 ThAC.5

Optimal Operation of a Residential Energy Hub

rasouli dogaheh, zahra — Univ. Pol. De Catalunya

Puig, Vicenç — Univ. Pol. De Catalunya (UPC)

In this study, the performance of smart grids is optimized in relation with residential energy centers equipping with solar photo-voltaic (PV) units. In this regard, two optimization algorithms are used to reduce energy costs and the results of the two methods are compared with each other. The results obtained from this study can be used by three groups of external consumers, environmental experts and energy suppliers. Big home appliances consume large part of household energies. With the use of a smart control tool, consumers can program home appliances daily or weekly to pay less by using them in non-peak load time. Hub energy is a concept that has been considered in energy systems mixed with multiple energy carriers. A hub is determined as the locus of activity of system. Certainly, a hub is energy core, in which all activities associated with a system including generation, storage and consumption of energy in applied equipment are determined. In this research, YALMIP toolbox in MATLAB software is used for optimization of energy consumption with the objective of reduction of costs created by fossil fuels with regarding generation ability of a PV generation unit.

Using this toolbox, right time to turn each appliance on is specified due to the practical limitations of the appliances and the maximum possible application of PV unit as clean energy generation is done.

10:10-10:30 ThAC.6

H_infinity Sliding Window Observer Design for Lipschitz Discrete-Time Systems

GASMI, Noussaiba Univ. of LORRAINE
Boutayeb, M. Lorraine Univ
THABET, ASSEM Univ. OF GABES
Aoun, Mohamed National Engineering School of Gabes, Tunisia. Res. Unit Of

This paper focuses on the H_infinity$ observer design for Lipschitz discrete-time nonlinear systems. The main idea consists in using previous measurements in a Luenberger observer through a sliding window to obtain less restrictive constraint. Reformulations of both Lipschitz property and Young's relation are used to offer greater degree of freedom to the obtained constraint. The presented result is in the form of BMI (Bilinear Matrix Inequality) which is transformed into LMI (Linear Matrix Inequality) through an interesting approach. The resulting constraint can be easily achieved with standard software algorithms. Then, to prove the superiority of the proposed design methodology, a comparison with the classical case is presented. Numerical examples are given to illustrate the effectiveness and the high performances of the proposed filter.

ThAD Room 2.13, Nexus building (second floor)

Autonomous System (Regular Session)

08:30-08:50 ThAD.1

Cooperative System with UAV and UGV for Disaster Area Exploration

Hakukawa, Takaya Nihon Univ
Uchiyama, Kenji Nihon Univ
Masuda, Kai Nihon Univ

Unmanned Aerial Vehicle (UAV) and Unmanned Ground Vehicle (UGV) are expected to be widely active in exploring disaster area. However, each unmanned vehicle has problems such as short flight time or poor efficiency of the exploration. As a solution of these problems, a cooperative system between these vehicles is useful by compensating disadvantages each other. In this paper, we propose the cooperation system using quadrotor UAVs and a UGV. In the system, the potential function method that can flexibly cope with a change of environment without computational complexity is used to avoid obstacles and reach the desired position. UAVs transmit data of obstacles to a UGV so as to explore a disaster area efficiently. Super-twisting sliding mode observer (STSMO) is treated for estimating velocities of the vehicles to avoid deterioration of control performance. The validity of the proposed control system is verified through numerical simulations.

08:50-09:10 ThAD.2

Fault Tolerant Adaptive Control Using Time Delay Control Scheme under Motor Faults of Octocopter

Lee, Jangho Korea Aerospace Res. Inst
Ryu, Hyeok Korea Aerospace Res. Inst
Lee, Dasol Korea Advanced Inst. of Science and Tech
Shim, David Hyunchul Korea Advanced Inst. of Science and Tech
Shin, Dongho Korea Univ. of Tech. and Education

In this study, we propose a control technique to stabilize the attitude of multicopters with some faulty motors by using the other normal motors. Existing studies on fault-tolerant control of multicopters are mainly on i) techniques to change the principal axis through tilting to secure the control force, and ii) application of a control allocation method to hexacopters and octocopters that have extra rotors. However, these methods have a disadvantage in that, for small multicopters, additional mechanical devices for tilting and algorithms for fault detection and isolation are required. Therefore, in this study, we propose a time delay control technique, which is a robust adaptive control method that does not require tilting of the principal axis or algorithms for fault detection and isolation in case of fault occurrence and can follow the attitude of a multicopter even in uncertain situations. In contrast to the existing flight control method of multicopters, the proposed method has a reliable performance against motion modeling error and disturbance owing to its robust control against uncertainty. It was verified by simulation and flight tests that the proposed control technique can stabilize the attitude of a multicopter and follow the given attitude command even in the event of faults.

09:10-09:30 ThAD.3

Extended State Observer Based Hierarchical Control for Quadrotor UAV

Mouad, Kahouadji Univ. De Tlemcen
Mokhtari, Mohammed Rida Univ. Aboubekr Belkaid Tlemcen
Choukchou-Braham Amal, Amal Univ. De Tlemcen
Cherki Brahim, Brahim Univ. De Tlemcen

This paper presents an original control strategy based on the Extended State Observer -ESO- position and orientation control problem of a small rotorcraft Unmanned Aerial Vehicle subjected to unknown aerodynamic efforts. A hierarchical control approach is applied to separate the flight control problem into translational and rotational controllers based on the time-scale property of each subsystem. An Extended State Observer -ESO- is used to estimate the state and the unknown aerodynamic disturbances. Closed loop stability of the system is established. Numerical simulations are carried out and results are presented to demonstrate efficiency of the proposed control strategy.

09:30-09:50 ThAD.4

Dspace Real-Time Implementation of Sliding Mode Maximum Power Point Tracker for Photovoltaic System

boutabba, tarek Univ. of Batna "algeria"
DRID, Said Unversity of Batna
CHRIFI-ALAOUI, Larbi Univ. De Picardie Jules Verne
Mehdi, Driss Univ. De Poitiers
Benbouzid, Mohamed Univ. of Brest
Alibi, Abdelaali Univ. of Batna 2
ouriagli, mohammed Faculté Pol. De Taza Univ. Sidi Mohammedben Abd

Maximum power point trackers are so important in photovoltaic systems to improve their overall efficiency. This paper presents a photovoltaic system with maximum power point tracking facility. An intelligent Sliding mode controller method is proposed in this paper to achieve the maximum power point tracking of PV modules. The system consists of a photovoltaic solar module connected to a DC-DC boost converter. The system is modeled using MATLAB/SIMULINK. The system has been experienced under disturbance in the photovoltaic loads and irradiation levels. The simulation results show that the proposed maximum power tracker tracks the maximum power accurately and successfully in all tested conditions. The MPPT system is then experimentally implemented. DSPACE is used in the implementation of the MPPT hardware setup for real-time control. Data acquisition and system control are implemented using dSPACE 1104 software and digital signal processor card. The experimental results show the efficiency of the proposed algorithm and confirm the simulation results.

09:50-10:10 ThAD.5

Experimental Control of a Doubly Fed Induction Generator Based Wind Energy Conversion System

Nouha Bouchiba, Nouha Bouchiba	Commande Des Machines Electriques Et Réseaux De Puissance (CMERP
Keskes Salma, Keskes Salma	National Engineering School of Sfax, ENISin National Engineering
sallem, souhir	ENIS
CHRIFI-ALAOUI, Larbi	Univ. De Picardie Jules Verne
DRID, Said	Unversity of Batna
KAMMOUN Mohamed Ben Ali, KAMMOUN Mohamed Ben Ali	Res. Unit: Commande Des Machines Electriques Et Res. De P

In recent years, electrical energy has become a vital component for human life. Moreover, the interest for alternative energy sources has an exponential rise nowadays as a consequence of the limitation in conventional energy sources. Wind energy is considered one of the most important renewable energy sources. Nowadays, in order to ensure an optimal energy use, management and control technologies of wind energy conversion system are developed rapidly. In this paper, both of the vector controller and sliding mode control strategy for an isolated doubly fed induction generator-based wind energy conversion system are studied, described, tested and compared. In order to ensure the safety of the connected load, the main purpose of the present work is to maintain output stator voltage and frequency at their reference values whether for load demand power variations and wind speed fluctuations. Experimental results demonstrate the effectiveness of the presented control strategies.

10:10-10:30 ThAD.6

On Fault Detection and Isolation Applied on Unicycle Mobile Robot Sensors and Actuators

MELLAH, Samia	Lab. Informatique & Systèmes -Aix Marseille Univ
Graton, Guillaume	Ec. Centrale De Marseille
EL ADEL, El mostafa	Univ. AIX Marsille III
Ouladsine, Mustapha	Univ. D'aix Marseille III
Planchais, Alain	STMicroelectronics

In this paper, a combination of model-based and hardware redundancy methods is proposed for both sensor and actuator fault detection and isolation (FDI) of unicycle mobile robots. A focus is brought on robot drift-like faults on wheels and sensors. The goal is to detect and isolate the faulty component as early as possible. The proposed method is based on a combination of hardware redundancy and a bank of Extended Kalman Filters (EKF). Each filter is tuned for a specific fault, to generate residuals with different signatures under different component faults. The different signatures allow the fault isolation. Simulation results show that the proposed method allow to detect both wheels and sensors small drift-like faults and isolate them as early as possible.

ThBA Room 2.10, Nexus building (second floor)

Renewable Energy and Power Systems (Regular Session)

11:00-11:20 ThBA.1

An Advanced Energy Management System with an Economical Optimization for a Multi-Sources Stand-Alone Home

Alnejaili, Tareq — Poitiers Univ
Mehdi, Driss — Univ. De Poitiers
DRID, Said — Unversity of Batna
CHRIFI-ALAOUI, Larbi — Univ. De Picardie Jules Verne
Alibi, Abdelaali — Univ. of Batna 2

This paper proposes an advanced energy management system (EMS) for a stand-alone hybrid energy system. The considered hybrid system includes a photovoltaic panel, a fuel cell, an electrolyzer and a battery bank. The EMS aims to optimize the utilization cost of the hybrid power system and to improve its energy balance with the elimination of any energy deficit. The hybrid power system has been tested by simulation using models implemented in Matlab/Simulink software. The simulation is performed over a long period of time in order to evaluate the effectiveness of the management strategy. The simulation results confirm the efficiency of the proposed control strategy, as it increases the reliability of the system and improves its energy balance.

11:20-11:40 ThBA.2

The Dynamic Control and Optimal Management of the Energy in the Case of a Territory Isolated in Batna City

Sahraoui, HAMZA — Batna Univ. 2
CHRIFI-ALAOUI, Larbi — Univ. De Picardie Jules Verne
Alnejaili, Tareq — Poitiers Univ
DRID, Said — Unversity of Batna
Mehdi, Driss — Univ. De Poitiers
ouriagli, mohammed — Faculté Pol. De Taza Univ. Sidi Mohammedben Abd
Bussy, Pascal — Univ. De Picardie Jules Verne

This paper deals with the optimal sizing and management of power system for medium rural health clinic located in the Batna region (Algeria). The study evaluates different power configurations depending on economic, environmental and technical characteristics. The main objective is to cover the entire loads with an uninterruptible, high quality power supplies with lowest cost of energy and high renewable energy penetration.

11:40-12:00 ThBA.3

Control and Optimal Management of a Multi-Source Energy System

Alnejaili, Tareq — Poitiers Univ
Mehdi, Driss — Univ. De Poitiers
Sahraoui, HAMZA — Batna Univ. 2
DRID, Said — Unversity of Batna
CHRIFI-ALAOUI, Larbi — Univ. De Picardie Jules Verne
Alibi, Abdelaali — Univ. of Batna 2

The main aim of this work is to develop an energy management algorithm (EMS) that control renewable energy system that consists of PV panels, lead acid battery banks and supercapacitor. On addition to that a Graphical user interfaces is developed to control the power system. The efficiency of the controller was tested by the mean of simulation, the result assume the effectiveness of the proposed control method and the intelligent management of the power flow controller

12:00-12:20 ThBA.4

A New Maximum Power Point Tracking Algorithm for Partial Shaded Photovoltaic Systems

RADJAI, Tawfik — 1Optics Department, Inst. of Optics and Precision Mechanics
GAUBERT, JEAN-PAUL — Univ. OF POITIERS
RAHMANI, Lazhar — Lab. of Automatic, Univ. of Ferhat Abbas SETIF-1

In this paper, a new maximum power point tracking MPPT algorithm is proposed to track the global maximum power point (GMPP) under partial shading conditions (PSC). The proposed algorithm can track the real GMPP under any PSC patterns and under any weather conditions with improving the tracking speed and reducing the PV output power oscillations at the steady state. The proposed algorithm is simple and easy to implement, because additional sensors or electrical switches are not required to identify the GMPP. The idea of the proposed method is based mainly on the scanning of the PV curve with a variable step of the duty cycle from zero to one. The scan step will be small when the operating point is near the MPP, otherwise, the scan step will be large to skip the regions that do not need to be scanned on the PV curve. Therefore, the scan time will be reduced and the MPPs are accurately detected. Furthermore, the algorithm stores only one MPP during the scanning process, stores only the data position of the greatest maximum power of the PV curve in each sample time Ts. Therefore, the execution of the embedded program in the calculator is optimized. In order to maintain the operating point at the GMPP after the scanning is finished a simple proposed sub-program will be used. In this work, a controlled Cuk DC–DC converter was used and connected to a Kyocera KC50T PV panel to verify the performance of the proposed method. Matlab/SimulinkTM was used for the simulation studies.

12:20-12:40 ThBA.5

Simulation and Real Time Implementation of Direct Power Control Applied to Parallel Active Filtering Based on Fuzzy Logic Controller

OUCHEN, Sabir — Lab. of Electrical Drives and Power Electronics of Applied
GAUBERT, JEAN-PAUL — Univ. OF POITIERS
Steinhart, Heinrich — Lab. of Electrical Drives and Power Electronics of Applied

Blaabjerg, F. Aalborg Univ. Inst. of Energy Tech
betka, achour Univ. of Biskra

The present paper proposes a simulation and a real time implementation of a new fuzzy-direct power control (F-DPC) strategy for power quality improvement in shunt active power filter systems. The main objective of the proposed study is to reduce the total harmonic current distortion (THDi) and the instantaneous power ripple. This is done by the replacement of the hysteresis regulators by fuzzy logic rules. The basic idea of these rules is based on the knowledge of the variation in the active and reactive power. In respect to the input fuzzy variables and in a precise instant, the best switching state of the converter is chosen. The strength of this control strategy compared to the conventional DPC is that it is not required to introduce hysteresis controllers and strong control of active and reactive power is achieved. The proposed F-DPC control is simulated using Matlab/Simulink and experimentally validated on a small-scale system, controlled via a dSPACE 1104 single card. The obtained results indicate a closeness between simulation and experimental tests, which proved and verified the effectiveness of the proposed F-DPC control strategy.

12:40-13:00 ThBA.6

Control and Fuzzy Logic Supervision of a Wind Power System with Battery/Supercapacitor Hybrid Energy Storage

krim, youssef National Engineering School of Monastir
ABBES, Dhaker High Engineering School of Lille (HEI-Lille)
KRIM, Saber Univ. of Monastir
Mimouni, Mohamed faouzi Univ. of Monastir Tunisia

In this paper, we propose a control and fuzzy logic Power Management Supervisor (PMS) for a grid-connected wind power system associated with Hybrid Energy Storage (HES) made up of Batteries (BT) and Supercapacitor (SC). Batteries are used to meet the energy requirements of a long-term, while SC is used to meet the demand for instant power. The SC can act as a buffer against large magnitudes and rapid fluctuations of power. The PMS is developed to manage the energy flows between the storage devices, by maintaining their State Of Charge (SOC) into acceptable levels, and to establish the priority order between them. The main objective of this work is the combination of two storage technologies with fuzzy logic supervision. It aims to meet the expectations of various production scenarios for a wind generator, to keep stable the DC bus voltage, and to participate in ancillary services such as: respecting a production program, supporting the grid and optimizing storage elements lifespan. Simulation results prove the efficiency of proposed power control and supervision strategy.

13:00-13:20 ThBA.7

Learning Upper-Level Policy Using Importance Sampling-Based Policy Search Method

Pastor Alcaraz, Jose Manuel Univ. Pol. De València
Diaz Iza, Henry Paul Univ. Pol. De Valencia
Armesto, Leopoldo None
Esparza, Alicia Univ. Pol. De Valencia
Sala, Antonio Univ. Pol. De Valencia

Policy search methods are a successful approach to reinforcement learning. These allow to learn upper-level policies whose main advantage is that these distributions explore directly in the parameter space. The contribution of this paper is to propose an algorithm based on importance sampling methods and local linear regression that uses the samples in an efficient way. In order to get this aim, we propose to include information of all the past samples in the learning process using importance sampling methods. Additionally, we use the gradient direction of the linear local model reward to explore regions where the prediction of the reward could be better.

ThBB Room 2.11, Nexus building (second floor)

Control Applications I (Regular Session)

11:00-11:20 ThBB.1

Independent Velocity Control of the Longitudinal Motion of Quadrotors

KOUMBOULIS, FOTIOS — Tech. Education Inst. of Sterea Ellada
Kouvakas, Nikolaos — Sterea Ellada Inst. of Tech

The problem of independent control of the horizontal and the vertical velocity in the longitudinal motion of a quadrotor in cruising mode is studied. A two-layer controller design scheme is proposed. Using the inner controller, the design requirement of triangular decoupling is satisfied and the general expressions of the controller matrices and the triangular closed loop transfer matrix are analytically determined. For the external loop, a MIMO PID controller is designed to achieve diagonal decoupling with simultaneous stability. The results are successfully applied and tested through a nonlinear computational experiment for a climbing maneuver.

11:20-11:40 ThBB.2

Development of Electro-Thermal Model of Lithium-Ion Battery for Plug-In Hybrid Electric Vehicles

Shoeb, Walaa — Faculty of Electronic Ngineering
Kamal, Elkhatib — LAGIS FRE CNRS 3033, Lille, France
Aitouche, Abdel — CRISTAL/HEI
SOPEH, ABDEL-AZIM — Faculty of Electronic Ngineering

Batteries in hybrid and battery electric vehicles play a Lithium-ion batteries play an important role as energy storage systems in automotive applications like hybrid electric vehicles. For an efficient use in such applications, accurate practical electro-thermal circuit and battery models for Lithium-ion cells are proposed in this paper. The main objective of this paper is to present a model, which can be used in the design process of battery packs, starting with the simulation of battery behavior to the point of model-based energy management controllers and cooling strategies. First, an accurate, intuitive, and comprehensive electrical model has been proposed to capture the entire dynamic characteristics of a battery, from nonlinear open-circuit voltage, current, temperature, SOC and storage time-dependent capacity to transient response. Next, the thermal model is used to estimate the heat generation inside the battery. Parameter estimation for both parts of the model is done separately in a two-stage algorithm by fitting the model output to experimental data. Finally, the coupled electro-thermal model is validated using experimental data. The experimental results show the effectiveness of models proposed.

11:40-12:00 ThBB.3

Event-Based Cascade Controller for Nitrogen Removal in Wastewater Treatment Plant

Vilanova, Ramon — Univ. Autonoma De Barcelona
Pedret, Carles — Univ. Autonoma De Barcelona
Santin, Ignacio — Univ. Autonoma De Barcelona
Barbu, Marian — Dunarea De Jos Univ. of Galati

This paper addresses the problem of nitrogen removal in wastewater treatment plants. The plant operation is stated in terms of a cascade control configuration where the ammonia concentration at the output of the last reactor determines the set-points of the three aerated tanks. In addition, the usual nitrate control loop for the second anoxic tank is also in place. The problem is addressed here within the framework provided by the Benchmark Simulation Model Number 1 (BSM1) and by the use of an event-based solution. As far as to the knowledge of the authors, no solution based on this kind of controllers has been proposed already in the literature. The controllers are taken as of similar complexity as the ones provided as default control strategy in the BSM1, therefor being the main difference, the possibilities provided by the event-based implementation. It will be verified that the solution can improve the performance of the already existing controllers both at loop level as well as at plant operation level.

12:00-12:20 ThBB.4

Fault Estimation and Tolerant Control for Vehicle Lateral Dynamics

El Youssfi, Naoufal — USMBA
Oudghiri, Mohammed — Univ. of Picardie Jules Verne

12:20-12:40 ThBB.5

A Backstepping Torque Control of a Five Phase Permanent Magnet Synchronous Machine

sari, Bilal — Setif Univ
Benkhoris, Mohamed Fouad — Pol. Nantes, Univ. De Nantes
HAMIDA, Mohamed Assaad — Ec. Centrale De Nantes, IRCCyN
Chouaba, Seif Eddine — Univ. of Setif

This paper is concerned with a backstepping torque control of five Phase Permanent Magnet Synchronous Machine (5P-PMSM). A non-sinusoidal EMF is considered. The design procedure of the control scheme is discussed. Indeed, the objective of the proposed backstepping controller is the minimization of electromagnetic torque ripples due to the non sinusoidal EMF, and also the minimization of the copper losses. Simulation results show the effectiveness of our design, with good transient performances and an excellent torque ripples reduction

12:40-13:00 ThBB.6

Advanced Disturbance Rejection Control of Smart Flexible Structures

Nestorovic, Tamara — Ruhr-Univ. Bochum
Oveisi, Atta — Mechanik Adaptiver Systeme, Inst. Computational

Controller design, as an integral step in the overall design of smart structures, plays a crucial role in active vibration suppression. Whereas well established control techniques like optimal LQG or PID controllers may perform well under assumption of the linear structural behavior, which can be described with sufficient accuracy by an LTI model, control task becomes much more complex in the presence of nonlinearities and uncertainties. In this paper we propose a feedback controller based on the recurrent wavelet neural network (RWNN) which is designed and trained to track the states of an ideal state-feedback controller, designed for the underlying linear model of the plant. In addition, adaptive neural network observer is designed to estimate the unnknown model dynamics associated with the nominal LTI model of the plant. Real time implementation of the proposed controller is realized on a Hardware-in-the-Loop setup with a flexible clamped-free beam and dSPACE system and tested for disturbance rejection tasks through a worst-case study in the presence of disturbances which cause resonant states.

13:00-13:20 ThBB.7

Mras Sensorless Speed Control of an Induction Motor Drive Based on Fuzzy Sliding Mode Control

fereka, Dhaouia — National High School of Oran
Zerikat, Mokhtar — Ec. Normale Supérieure De L'enseignement Tech. D'oran
belaidi, abdelkader — High National Pol. School of Oran Maurice Audin

This paper is focussed on a MRAS sensorless speed control based on hybrid fuzzy-sliding mode control strategy associated with the field-oriented control of induction motor drives. In order to improve the performance of the speed sensorless vector controlled induction motor drives, an hybrid is included. The analysis, design of the MRAS sensorless control based on fuzzy-sliding mode controller for indirect vector control of induction motor are analyzed and presented. The model is carried out using Matlab/Simulink software. The main advantages of the proposed chattering-free speed controller are robustness to parameter variations and load changes. The results are shown to verify the effectiveness of the proposed speed controller and its advantages are shown in comparison with the conventional SMC and Fuzzy Sliding Mode Controller FSMC.

ThBC Room 2.12, Nexus building (second floor)

Renewable Energy (Regular Session)

11:00-11:20 ThBC.1

A Survey on Energy Management and Blockchain for Collective Self-Consumption

Stephant, Matthieu — Univ. Lille, Arts Et Metiers ParisTech, Centrale Lille, HEI, EA
Hassam-Ouari, Kahina — HEI Lille
ABBES, Dhaker — High Engineering School of Lille (HEI-Lille)
Labrunie, Antoine — GB Solar
Robyns, benoit — HEI-L2EP

This paper gives a definition of collective self-consumption and introduces the current regulatory framework in some European countries. It proposes a review of relevant Demand Side Management (DSM) methods applicable to improve the collective self-consumption rate. It also introduces the concept of blockchain and its possible applications to collective self-consumption, with a focus on some current experimentations. Current blockchain applications include validation of measured data and energy transactions. New architectures propose a completely decentralized energy market and grid control based on the blockchain technology. However, a deeper analysis of the benefit of blockchain is required. The legal framework will also play a role on the future deployment of these applications.

11:20-11:40 ThBC.2

Control of Energy Transfer between a Storage Battery and the Electricity Grid

Khabou, Hajer — Enis, Lab-Sta
Souissi, Mansour — Engineering School of Sfax, Tunisia
Aitouche, Abdel — CRISTAL/HEI

This paper studies the transfer of energy between the low-voltage grid and a battery through an inverter. The inverter is used to control the transfer of energy from the battery to the grid. The concept of multilevel voltage source inverter is described. A Takagi Sugeno fuzzy controller is employed to control the voltage inverter to ensure a constant DC link voltage. The gains of the controller are calculated using linear matrix inequalities (LMI). The stability analysis of the system is performed using the Lyapunov and H-infinity theorem performance. The results of the simulation are made using MATLAB / SIMULINK to test the effectiveness of the proposed control algorithm. The validity of the model and its control strategies are greatly confirmed by the extensive simulation results.

11:40-12:00 ThBC.3

Impacts of PV Penetration into LV Distribution Network: Case Study for Southeast Region of Tunisia, Sfax

SOUIFI, Hayfa — National School of Engineers of Sfax-Tunisia (ENIS-Tunisia)
ASHAMMARI, BADR — Univ. of Hail
omar, Kahouli — National School of Engineering of Sfax
Haj Abdallah, Hsan — Sfax Engineering National School

The penetration of photovoltaic (PV) system into the low-voltage distribution networks (LV-DNs) has become, in the few last years, a main international trend, encouraged by the sinking prices of PVs. However, this integration may impact the normal operation of the DNs in both beneficial and detrimental ways. In this context, this paper is an attempt in order to investigate the effects of the PV integration on the LV-DNs. This study has been carried out for a portion of a real LV-DN in the region of Sfax, Tunisia. Different scenarios of demand level and PV production are presented and carefully discussed so as to assess the technical impacts occurred by the PV systems integration. For the load-flow analysis, a Backward/Forward sweep algorithm was used.

12:00-12:20 ThBC.4

Architecture for Embedded Supervisory System of Distributed Renewable Energy Sources

Miron, Cristian — Pol. Univ. of Bucharest
Olteanu, Severus Constantin — LAGIS UMR CNRS 8219, Pol. 59655, Villeneuve D'ascq
Christov, Nicolaï — Univ. Des Sciences Et Tech. De Lille
Aitouche, Abdel — CRISTAL/HEI

The purpose of the paper is to present an architecture of an embedded solution for system supervision of distributed renewable power systems. This work is a first step towards an IoT solution, appropriate for small power, but spread renewable energy solutions as in smart residences. The OPC protocol is chosen as the most suitable solution for long distance communication, whereas serial communication is employed for short distances. The OPC server/client platform is microprocessor based, while the generators are controlled through microcontrollers that interact through serial communication with local OPC nodes. The microcontrollers can provide the supervisor with different parameters, such as voltage, current, control value, but can also receive parameters, such as the set point of the generated power, solar irradiation, temperature. The multiplatform capabilities of the python language are considered. A validation is realized via Arduino boards as local controllers for the generators and Raspberry Pi boards as OPC server/clients and a global supervisor is developed in Matlab. The solution is interesting as it gives a strong modularity and easy access to portable solutions on the ground.

12:20-12:40 ThBC.5

Fuzzy Control for Maximum Power Point Tracking of a Photovoltaic System

Ben Safia, Zeineb — Lab-STA/ENIS, Sfax, Tunisia
Allouche, Moez — Engineering School of Sfax, Tunisia
Harrabi, Naziha — Lab-STA/ENIS, Sfax, Tunisia
Mohamed, BAHLOUL — Lab-STA/ENIS, Sfax, Tunisia
Chaabane, Mohamed — Lab-STA/ENIS, Sfax, Tunisia

This paper proposes a new T-S fuzzy method to deal with the power tracking problem of the power generating systems. First, a dynamic model of the PV system is developed which is subsequently converted into a Takagi-Sugeno (TS) model. Then, after leading to this exact model, a 풇∞ fuzzy controller is designed to obtain the MPP even during the variation of the climatic conditions. Based on the T–S fuzzy model, the fuzzy maximum power point tracking controller is designed by constructing fuzzy gain state feedback controller and an optimal reference model for the optimal PV output voltage, which corresponds actually to maximum power point (MPP). The controller gains are obtained by solving a set of linear matrix inequalities (LMIs). Finally, simulation results are given to illustrate the optimal tracking performance of the proposed fuzzy controller even in the case of abrupt changing climatic conditions.

12:40-13:00 ThBC.6

Mathematical Model of a Cogeneration System Composed of a Floating Wind Turbine and Two Marine Current Turbines

Tamarit, Fernando UPV
Garcia, Emilio UPV
Correcher, Antonio Tech. Uniersity of Valencia
Quiles, Eduardo UPV
Morant, Francisco UPV

This paper develops the mathematical model of a cogeneration system composed of a floating wind turbine –type "OC3-Hywind"– and two marine current turbines with the aim of increasing the energy generated by the floating installation and, at the same time, offering the possibility of using those turbines as actuators, being the later useful for the stabilization of the platform in hard weather conditions.

The mathematical model for this system has been developed using Matlab. In this tool, several tests have been carried out on the structural stability of the system considering the interactive phase of the acting forces.

We have used Matlab to freely design the mechanical system and thus, achieve the desired model, which are a wind turbine type OC3-Hywind and two current turbines.

The capacity of Matlab offers the possibility of evaluating the cogeneration system with different geometries, aerodynamic airfoils and external meteorological conditions; and also including or eliminating certain elements, etc. This versatility will be useful in future studies aimed to evaluate this system and maximize the production of energy.

In this paper, the first version of the tool is introduced using the “one-dimensional momentum theory” to compute the thrust of the turbines. This theory allows the obtainment of a good approximation to know which will be the behavior that the steady state response system will have. The operational capacity of the tool has been validated by comparing the results with the certificated test of the OC3-Hywind calculated in FAST 8.

13:00-13:20 ThBC.7

Modified Direct Feedback Linearization Excitation Controller for Transient Stability and Voltage Regulation of SMIB Power System

Keskes Salma, Keskes Salma National Engineering School of Sfax, ENISin National Engineering
Nouha Bouchiba, Nouha Bouchiba Commande Des Machines Electriques Et Réseaux De Puissance (CMERP
sallem, souhir ENIS
CHRIFI-ALAOUI, Larbi Univ. De Picardie Jules Verne
KAMMOUN Mohamed Ben Ali, KAMMOUN Mohamed Ben Ali Res. Unit: Commande Des Machines Electriques Et Res. De P

In this paper, a modified direct feedback linearization method for transient stability and voltage regulation of power systems is discussed. Starting with the classical direct feedback linearization technique currently applied to power systems, a modification is proposed in the equation of excitation control of synchronous generators in order to eliminate the static error of the terminal generator voltage. This modification takes into account the change of the reactance line after a three-phase short circuit. The proposed method is based on a standard third-order model of a synchronous generator which requires only information about the physical available measurements of angular speed, active electric power and generator terminal voltage. Simulation results show that this technique presents a fast response and a robustness compared with the Power System Stabilizer (PSS) and the Direct Feedback Linearization (DFL). They also demonstrate that the damping, the steady-state and the transient stability as well as voltage regulation are all achieved satisfactorily.

ThBD Room 2.13, Nexus building (second floor)

Robust Control and Hinfty Control (Regular Session)

11:00-11:20 ThBD.1

Design of Backstepping-Sliding Mode Controller for a Bidirectional Grid Connected DC/AC Converter

Mohamed, BAHLOUL Lab_sta

Shafi, Khadem IERC, Tyndall National Inst

Mehdi, Driss Univ. De Poitiers

GAUBERT, JEAN-PAUL Univ. OF POITIERS

Abstract--- In this paper, design of a nonlinear controller for grid connected bidirectional converter is presented. A backstepping sliding mode (BS-SM) approach is used, and two control algorithms are proposed. The first one uses a classical design approach. However, the second BS-SM controller design relies on an accurate Lyapunov stability analysis. Simulation studies are presented while considering in the first step, the nominal parameters of the system, and in the second step, variations or uncertainties that can impact the inductance of the RL filter. The analysis outcome shows the superiority and the robustness of the second proposed BS-SM controller to deal with transients and to guarantee a better performance of the proposed controller under different operating conditions.

11:20-11:40 ThBD.2

Fault-Tolerant Tracking Control for a Biological Process: Multiple Lyapunov Function Approach

ABYAD, Mohamed Cadi Ayyad

karama, Asma Cadi Ayyad Univ

khallouq, abdelmounaim Cadi Ayyad

This paper addresses trajectory tracking and active Fault Tolerant Control (FTC) of a nonlinear biological process affected by actuators faults. The nonlinear biological process transformed to a fuzzy Takagi-Sugeno (T-S) model, then a nominal control based on the optimal Linear Quadratic Integral (LQI) is synthesized for ensuring the trajectory tracking. To build the active fault tolerant control, a Proportional Integral Observer (PIO) is proposed to estimate simultaneously the actuators faults and states, the estimated faults used to reconfigure the nominal control. the new conditions of convergence to increase the fault compensation speed are proposed, which based on multiple Lyapunov function. The proposed method is applied to the bacterial growth process and their efficiency is demonstrated via simulations.

11:40-12:00 ThBD.3

Regional Pole Assignment for Constrained Input Uncertain Systems

KHALLOUK, Hamza LAEPT, Cadi AYYAD Univ

Mesquine, Fouad Cadi Ayyad Univ

This paper addresses the pole assignment problem in DR-regions for input constrained uncertain systems. A robust state feedback controller is built such that: 1) the closed loop poles lie within a specified stability region; 2) the symmetric input constraints are respected. Conditions for both stability analysis and controller synthesis are given in terms of linear matrix inequality (LMIs). Simulation results are worked out to demonstrate the effectiveness of the proposed technique.

12:00-12:20 ThBD.4

Reconciling Full-Order LPV Design and Augmented Structured H-Infinity Via Internal Model Principle: A Launch Vehicle Application

Navarro-Tapia, Diego Univ. of Bristol

Marcos, Andres Univ. of Bristol

Bennani, Samir ESA/ESTEC (TEC-Ec

Roux, Christophe ELV S.p.A

This article presents an indirect method to characterize a wind disturbance internal model that can be used to augment the capabilities of a classical controller structure for the atmospheric-phase thrust vector control (TVC) system of the VEGA launcher. This characterization is based on a comparison between a structured H-infinity and a full-order LPV controller with better performance levels. The identified wind model is then explicitly employed to re-design the structured H-infinity controller in order to achieve similar levels as the full-order LPV controller. This design reconciles the current VEGA control system architecture with the internal model principle, which states that a controller must have structural features to contain the internal model of the signal to be controlled. The effect of this new controller structure is analysed in terms of robust stability and performance using the singular structured value mu technique. The results show that embedding the internal model structure in the control system provides an extra degree of freedom to improve the launcher performance against wind gusts.

12:20-12:40 ThBD.5

Robustness Improvement Using the Filtered Smith Predictor Based Fractional Integral-Fractional Derivative Controllers: Application to a Pressure Plant

Azarmi, Roohallah K. N. Toosi Univ. of Tech

Tavakoli-Kakhki, Mahsan K. N. Toosi Univ. of Tech

Vilanova, Ramon Univ. Autonoma De Barcelona

Fatehi, Alireza K.N. Toosi Univ. of Tech

Khaki Sedigh, Ali K.N. Toosi Univ. of Tech

This article presents a simple frequency domain control technique to tune the parameters of a filtered Smith predictor based fractional integral-fractional derivative (FSPFIFD) controller. The proposed method provides a practical approach to compensate stable First Order Plus Dead Time (FOPDT) transfer functions based on a filtered Smith predictor (FSP) control structure. In this control structure, an integer order predictor filter is used to improve the noise reduction of the control system. By benefiting from the proposed FSPFIFD controller, not only the phase margin and the gain crossover frequency of the control system are adjustable by tuning the free controller parameters, but also the robustness of the compensated system is enhanced. Finally, the designed FSPFIFD controller is

implemented on a laboratory scale pressure plant and the obtained results are compared with those of applying a filtered Smith predictor based PI (FSPPI) controller in a similar structure. The practical results demonstrate the simplicity of application and the effectiveness of the proposed tuning rules.

12:40-13:00 ThBD.6

Further Results on H_infinity Filtering Design for Continuous Time-Systems with Time-Varying Delay Systems: Three Term Approximation Approach

El AISS, Hicham — Faculty of Science Dhar El Mahraz
ZOULAGH, TAHA — Univ. of Sidi Mohammed Ben Abdellah Faculty of Science, Phy
hmamed, abdelaziz — Faculty of Sciences Dhar Elmehraz Fes
El Hajjaji, Ahmed — Univ. De Picardie-Jules Verne
Bosche, Jerome — Univ. De Picardie-Jules Verne

This paper focuses on H_infinity filter design for systems with time-varying delay using Input Output approach. A new approximation of time varying delay is firstly proposed and then based on the scaled small gain theorem. Based on a new Lyapunov-Krasovskii functional, a novel asymptotic stability of the filtering error system is established. Thus, The H_infinity full and reduced-order filters are designed in terms of linear matrix inequalities (LMIs). Finally, illustrative example is presented to demonstrate the validity of the proposed methods.

13:00-13:20 ThBD.7

MPC-PID Control of Operator-In-The-Loop Overhead Cranes: A Practical Approach

Giacomelli, Marco — Univ. of Brescia
Faroni, Marco — Univ. of Brescia
Gorni, Domenico — Univ. of Brescia
Marini, Alberto — Univ. of Brescia
Simoni, Luca — Univ. of Brescia
Visioli, Antonio — Univ. of Brescia

In this paper, a velocity control system for industrial overhead cranes based on a Model Predictive Control approach is proposed. The problem of the control of the operator-in-the-loop system is addressed, as the operator drives the system pushing a button while the control algorithm drives the cart reducing the oscillations of the load. An inner velocity control loop is used in order to overcome some of the problems of controlling the system by using directly the torque of the motor as a control variable. Simulations show the effectiveness of the approach, in particular in the presence of friction.

FrAA Room 2.10, Nexus building (second floor)

Control Algorithms Implementation (Regular Session)

09:00-09:20 FrAA.1

Identification Method of Kinematic Parameters of Multilink Industrial Manipulator

Gubankov, Anton — Far Eastern Federal Univ
Yukhimets, Dmitry — Inst. of Automation and Control Processes

The paper deals with a method of identification of kinematic parameters of multilink industrial manipulators. This method does not require complex and expensive equipment for high-precision external measurements of position and orientation of the working tool in the absolute coordinate system. The method allows simple and cheap means to significantly increase the dynamic accuracy of the movement of working tools of serial manipulators along spatial trajectories during the performance of various technological operations. The simulation is considered.

09:20-09:40 FrAA.2

Synchronization of Perturbed Genesio-Tesi Chaotic Systems Via a New Finite-Time Controller

Tran, Xuan-Toa — Univ. National Inst. of Science and Tech
Oh, Hyondong — UNIST

This paper investigates the synchronization problem for perturbed Genesio-Tesi chaotic system. Based on Lyapnov stability theory, a new finite-time control method is proposed to ensure that the synchronization takes place in finite time. Numerical simulation results are provided to show the effectiveness of the proposed method.

09:40-10:00 FrAA.3

State Estimation and Hinf Sliding Mode Control for Fuzzy Descriptor Systems

Kchaou, Mourad — National School of Engineers of Sfax Tunisia
Toumi, Ahmed — ENIS/SFAX
Souissi, Mansour — Engineering School of Sfax, Tunisia
Chaabane, Mohamed — National Engineering School of Sfax, Tunisia

This paper is concerned with the problems of state estimation and sliding mode control for non-linear descriptor systems described by TS fuzzy models. In fact, using an appropriate fuzzy observer to estimate the system states, an integral sliding mode surface and an adaptive observer-based sliding mode controller will be designed to guarantee the closed-loop fuzzy descriptor system to be robustly stable with Hinf performances, insensitive to all admissible uncertainties and satisfies the reaching condition. The developed results are tested on a representative example to confirm the effectiveness of the theoretical developments.

10:00-10:20 FrAA.4

FPGA Implementation of SHEPWM Gate Signal IGBTs

imarazene, khoukha — Univ. of Science and Tech. Houari Boumediene (USTHB)
berkouk, el madjid — Ec. Nationale Pol. D'alger

This paper deals the generation of all signal gates for three-level inverter using FPGA SPARTAN-3E device. The PWM switching angles are computed on the basis of the selective harmonics elimination for several frequency values. In order to cancel three odd harmonics the arm voltage waveform profile contains four switching angles. For, the experimental results, three phase three level inverter hardware circuit is constructed using six IGBTs modules. Before configuring the FPGA device, all signals are checked on ModelSim environment. Experimental results using SAPRTAN-3E starter kit are presented validate the proposed implementation.

10:20-10:40 FrAA.5

Integral Backstepping/LFT-LPV H_infinity Control for the Trajectory Tracking of a Quadcopter

Hasseni, Seif-El-Islam — Univ. of Biskra
Abdou, Latifa — Mohamed Khider Univ. of Biskra

In this paper, a hybrid robust control strategy is proposed to solve the trajectory tracking of a quadcopter. The quadcopter model is divided into two subsystems; rotational subsystem and translational one. We present the rotational one as a quasi-LPV system and design an LFT-based LPV H∞ controller to achieve the stabilization of the orientation coordinates with taking into account the disturbances and the actuators' dynamics. On the other hand, in order to guarantee the trajectory tracking, the backstepping controller is designed for the translational subsystem with integral action, to get a null steady state error. The simulation results show the efficiency and the robustness of our controller against disturbances, noises and parametric uncertainties.

10:40-11:00 FrAA.6

Semi-Active Control of Stay Cable Vibrations Using Magnetorheological Damper

Gurav, Rohit Tukaram — IIT Madras
Ali, Shaikh Faruque — Indian Inst. of Tech. Madras

A nonlinear dynamic model of a small-sag stay cable with an axial support motion is considered. A magnetorheological (MR) damper is employed for semi-active control of cable vibrations. Voltage supplied to the MR damper has been monitored through a two-stage state feedback control design approach. The first stage contains a primary controller, which determines the force required to obtain a desired closed-loop response of the system. In the second stage, an optimal dynamic inversion approach has been used to obtain the amount of voltage to be supplied to the MR damper such that it provides the required control force prescribed by the primary controller.

FrAB Room 2.11, Nexus building (second floor)

Control Applications II (Regular Session)

09:00-09:20 FrAB.1

Explicit Model Predictive Control for a Cart Inverted Pendulum System

Lasheen, Ahmed Cairo Univ
Elnaggar, Mahmoud Cairo Univ

This paper discusses the implementation of the explicit model predictive control for the inverted pendulum system. The proposed controller has three merits. First, it is able to produce the optimal control action with constraints satisfaction. Second, it reduces the online computational time by obtaining the offline solution of the optimization problem. Third, it ensures the overall system stability. The simulation results show that the proposed controller achieves an excellent performance.

09:20-09:40 FrAB.2

Comparative Study of Two Control Strategies of a Multiterminal VSC-HVDC Systems

Rekik, Asma Univ. of Sfax National School of Engineering
Boukettaya, Ghada Univ. of Sfax National School of Engineering
kallel, randa Univ. of Sfax National School of Engineering

Voltage Source Converter High Voltage Direct Current (VSC_HVDC) is a hopeful technology for future smart grid and offshore applications. It can be used to feed weak networks and can be kept compact, which makes it more appropriated to build connections to offshore wind farms. The feasibility for such applications has been proven by projects all over the world. The development of renewable energies such as offshore wind energy as well as multiplication of HVDC links between the different countries of the Union European create the possibility to build a Multi-terminal HVDC (MTDC) offshore grid which is superimposed on the existing HVAC network. This paper focused on HVDC transmission systems with three terminals considered as the most plausible projects in the future. The main objective of this paper is to demonstrate the controllability of VSC-HVDC transmissions and to discuss on the existing principal controls such as master slave and voltage droop command. Simulation results show the drawback of the traditionnel master slave control and the effectiveness of the voltage droop control method.

09:40-10:00 FrAB.3

Control of Router Nodes in Production Manufacturing Processes

KOUMBOULIS, FOTIOS Tech. Education Inst. of Sterea Ellada
Fragkoulis, Dimitrios TEI of Piraeus
Ioannou, Constantine Tech. Education Inst. of Sterea Ellada

A generic monitoring and supervisory control scheme is proposed for a router node in manufacturing processes using Discrete Event Systems (DES). The generic model of the router node consists of m production machines with discrete products that place their products at a queue with r slots. The final products of the node will be produced by a (m+1)-th production machine that will be placed at the output of the queue. The final products will be categorized and be sent to m buffers through a distributor. For the control of the system two supervisors and one monitoring supervisor are designed and realized.

10:00-10:20 FrAB.4

Robust H ∞ Static Output Feedback Control with Input Constraints Using Descriptor Approach: Application for a Truck Trailer System

FERJANI, Amel National Engineering School of Sfax
Zaidi, Ines Univ. of Valladolid
El Hajjaji, Ahmed Univ. De Picardie-Jules Verne
Chaabane, Mohamed National Engineering School of Sfax, Tunisia

This paper describes an output feedback control with input constraints for a track trailer system. To this, a T-S disturbed model is proposed and a static output feedback control is designed. The designed controller not only ensures the stability of the resulting closed loop system but also the H ∞ performances. Based on Lyapunov theory, the controller gains are obtained by solving a set of Linear matrix inequalities (LMIs) constraints.

10:20-10:40 FrAB.5

Switching Control of DC Motor Using Multiple Fuzzy Cognitive Network Models

Karatzinis, Georgios Democritus Univ. of Thrace
Boutalis, Yiannis Democritus Univ. of Thrace
KARNAVAS, YANNIS Democritus Univ. of Thrace

A new DC motor multiple models switching control architecture is proposed in this paper, which is based on the framework of Fuzzy Cognitive Network (FCN) system modeling. A FCN is an operational extension of a Fuzzy Cognitive Map which incorporates proven stability and guaranteed exponentially-fast error convergence to zero during its training and supports at the same time the continuous interaction with the system it describes. In the proposed approach the network assumes functional interconnection weights instead of plain values and the acquired knowledge, during its training, is actually stored in multiple polynomial weight forms. Multiple models carry information associated with different areas of DC Motor operation leading to multiple local inverse FCN control actions, each one associated with the corresponding process model. The model that best approximates the plant in every time instant is determined through a switching rule based on a performance index. The incorporated multiple models may adapt and change their shape online enhancing the overall performance.

10:40-11:00 FrAB.6

A QFT Solution to the ACC Benchmark Tracking Problem

Elso, Jorge Public Univ. of Navarre
Miquelez, Irene Public Univ. of Navarre

Ostolaza, Xabier Univ. of the Basque Country

In this work, the Quantitative Feedback Theory (QFT) method is used to find a control solution for the well-known ACC benchmark problem. Unlike previous contributions, this one addresses the tracking problem. The solution is based on a two-degree-of-freedom control scheme. To cope with the demanding requirements of the problem, an innovative use of Bessel filters as tolerances is presented, replacing the usual second order models.

FrAC Room 2.12, Nexus building (second floor)

Estimations and Identification (Regular Session)

09:00-09:20 FrAC.1

Indoor Localisation Using Aroma Fingerprints: Comparing Nearest Neighbour Classification Accuracy Using Different Distance Measures

Minaev, Georgy Tampere Univ. of Tech

Müller, Philipp Tampere Univ. of Tech

Visa, Ari Tampere Univ. of Tech

Piché, Robert Tampere Univ. of Tech

Measurements from an ion mobility spectrometry electronic nose (eNose) can be used for distinguishing different rooms in indoor localisation. An earlier study showed that the Nearest Neighbour classifier with Euclidean distance for features provides reasonable accuracy under certain conditions. In this paper 66 alternative distance measures are compared to the Euclidean distance and principal component analysis (PCA) is applied to the data. PCA shows that the measurements on the various channels of the eNose are correlated and that using principal components 1, 2 and 4 increases the accuracy considerably. Furthermore, the experiments revealed three Pareto optimal distance measures that reduce the misclassification rate between 9-10% while using only 82-88% of the search time compared with Euclidean distance.

09:20-09:40 FrAC.2

Adaptive Notch Filters for Prediction of Narrow Band Signals

M'Sirdi, Kouider Nacer Lsis -Cnrs Umr 6168

Monneau, Antoine Lis Umr 7020

naamane, aziz Univ. Aix-Marseille (U3)

This paper proposes efficient structures of Adaptive Notch Filters (ANF) implemented as constrained ARMA models. These ANF suit very well for fast frequencies tracking and evolutionary spectrum analysis for narrow band and sinusoidal signals in additive noise. Lastly, non-stationary ANF are considered and an estimation procedure implemented.

09:40-10:00 FrAC.3

The Development of Fault Detection and Estimation System for Electric Servo Actuators of Manipulation Robots

Zuev, Alexander Inst. of Automationa and Control Processes FEB RAS

Filaretov, Vladimir Far Eastern Federal Univ

Zhirabok, Alexey Far Eastern Federal Univ

Procenko, Alexander Far Eastern Federal Univ

The problem of fault detection and estimation in electric servo actuators of manipulation robots to achieve fault accommodation is considered. It's supposed that electric servo actuators are described by nonlinear models with non-smooth nonlinearities. Fault detection problem is solved with help of logical-dynamic approach, which makes it possible to apply linear methods in diagnosing of nonlinear objects. To accurately estimate the real-time values of the appearing faults, it is suggested to add a special feedback by the residual signal in received observers that ensures the observer's work in a sliding mode.

10:00-10:20 FrAC.4

Identification of Ph Neutralization Process Based on a Modified Adaptive Fuzzy C-Regression Algorithm

Telmoudi, Achraf Jabeur Higher Inst. of Applied Sciences and Tech. of Sousse

SOLTANI, Moez High School of Science and Tech. of Tunis (ESSTT)

Chaari, Abdelkader Univ. of Tunis, ENSIT

This paper presents a new design procedure of an adaptive fuzzy c-regression model algorithm. The latter uses a fixed parameter in its objective function. To deal with this problem, we integrate an adaptive function into conventional adaptive fuzzy c-regression model in order to reduce the effect of an arbitrary choice of this parameter on the estimation accuracy of the model parameters. The proposed method is investigated and evaluated through the identification quality of the pH neutralization process. Finally, experimental results indicate the viability of the proposed algorithm.

10:20-10:40 FrAC.5

State of Health Estimation of Lead Acid Battery Bank in a Renewable Energy System by Parameter Identification with Genetic Algorithms

Banguero Palacios, Edison UPV

Correcher Salvador, Antonio Univ. Pol. De València

Perez-Navarro Gómez, Angel UPV

Garcia, Emilio UPV

Accurate prediction of battery energy storage system state of health is very important in renewable energy systems. This paper presents a methodology for state of health estimation of lead acid battery bank by parametric identification. A particle swarm optimization algorithm is used for parameter fitting of a real battery bank. A periodic perturbation is introduced in the population to prevent the algorithm from falling into local minimums. The perturbation will consist of a new population PSjk based on the best global solution allowing the reactivation of the PSO algorithm. The proposed method is validated using experimental data that is obtained from a renewable energy system located at Chocó - Colombia. The capacity, state of health, and internal resistance of the battery bank is estimated and the evolution of the parameters associated with the battery capacity are shown. The voltage and state of charge are estimated with high accuracy confirming the effectiveness and robustness of our method. The results show that the battery bank lost 5% of its nominal capacity, locating in a 95% his state of health. Moreover, it is observed that as of February, the battery bank current presents a significant increase that can lead to a deterioration and premature substitution of the battery energy storage system.

Two-Degree-Of-Freedom PID Tuning Based on an Uncertainty and Disturbance Estimator

Balaguer, Vicente — Univ. Pol. De Valencia
Sanz-Diaz, Ricardo — Inst. De Automática E Informática Industrial Univ. Pol
Garcia Gil, Pedro José — Univ. Pol. De Valencia
Albertos, Pedro — Univ. Pol. De Valencia

In this paper, a simple tuning method for two-degree-of-freedom (2DOF) PIDs is presented. The proposed methodology is based on an uncertainty and disturbance estimator. This model-based technique allows decoupling of the tracking and disturbance rejection performances. It is shown how, for second-order systems and with appropriate adjustments, an equivalent 2DOF PID controller can be obtained. The 2DOF PID parameters are then easily tuned to meet the desired tracking performance by specifying a reference model. Furthermore, one single parameter can be adjusted online to obtain a trade-off between disturbance rejection and robustness in each particular application. The proposed method is tested in a wide range of plants, including unstable first-order systems with time delay. Two comparisons with well-known tuning methods are performed.

FrAD Room 2.13, Nexus building (second floor)

Modelling of Complexe Systems (Regular Session)

09:00-09:20 FrAD.1

Bond Graph Model for Prognosis and Health Management of Mechatronic Systems Based on Energy Activity

Singh, Manarshhjot Univ. of Lille Pol

Ould Bouamama, Belkacem Pol. Lille

Gehin, Anne-Lise LAGIS

Kumar, Pushpendra Univ. Lille1, Pol. CNRS

Timely and accurate, detection and prediction, of fault is beneficial for every safety. However, it is a necessity for modern autonomous systems like autonomous vehicles and robots due to the absence of continuous human supervision. This paper attempts to establish energy as a viable parameter for fault identification. For this Element Activity Index is used as a metric for identification, calculated in this paper using only the sensor data. The proposed technique is then implemented on a bicycle vehicle dynamic model. Abrupt faults of different intensities are introduced in different elements of the model and their proper detection and isolation is checked using the proposed technique. The visibly different residual trends allow us to accurately detect the presence and also the location of the fault.

09:20-09:40 FrAD.2

Bond Graph Model-Based Control of the Quadcopter Dynamics

Matouk, Djihad Univ. of Batna 2

Ahmad, Faraz Graphic Era Deemed to Be Univ. Dehradun

Kumar, Pushpendra Univ. Lille1, Pol. CNRS

Merzouki, Rochdi Ec. Pol. De Lille

Singh, Manarshhjot Univ. Lille1, Pol. CNRS

Abdessemed, Foudil Department of Electronics, Faculty of Tech. Univ. Of

This paper presents graphical modeling and control of the quadcopter dynamics. A quadcopter is an under-actuated system with nonlinear dynamics. For stabilization of such complex system, it is necessary to have a nonlinear control. Therefore, a model-based control is developed for the altitude (height) and attitude (roll, pitch, and yaw) control of the quadcopter dynamics. The dynamic model of quadcopter is developed using a power-based graphical modeling tool, called bond graph. Subsequently, the bond graph model is used to develop altitude and attitude control of the quadcopter. Finally, the developed algorithm is validated through simulation.

09:40-10:00 FrAD.3

Bond Graph Based Power Consumption Estimation of a Non-Holonomic Wheeled Mobile Robot with Multiple Driving Modes

Kumar, Pushpendra Univ. Lille1, Pol. CNRS

Bensekrane, Ismail Univ. of Lille Pol

Singh, Manarshhjot Univ. of Lille Pol

Merzouki, Rochdi Ec. Pol. De Lille

This paper presents a method for estimation of power consumption of a non-holonomic Wheeled Mobile Robot (WMR) using a graphical modeling approach called bond graph. The considered WMR is an over-actuated four wheeled robot and can have different driving modes based on its steering scheme. Therefore, the main contribution of this paper is to develop a model for the power consumption estimation considering three driving modes of the robot namely, skid, front, and dual steering. The model is validated through simulation and experiment.

10:00-10:20 FrAD.4

An Improved Robust State-Feedback H_infty Control Synthesis for Uncertain Discrete-Time Singular Systems

Gonzalez, Antonio Univ. Pol. De Valencia

Guerra, Thierry Marie Univ. of Valenciennes

Garcia Gil, Pedro José Univ. Pol. De Valencia

In this paper, a sufficient condition based on linear matrix inequalities (LMI) is provided to address the robust state-feedback H_infty control synthesis of discrete-time singular uncertain systems. By applying state-space model reduction techniques and small gain theory, more efficient control synthesis algorithms are obtained in comparison to other similar approaches. The complexity of the involved algorithms is reduced, whilst keeping or even improving the closed-loop performance. Finally, some examples are borrowed from recent literature to illustrate the effectiveness of the proposed method.

10:20-10:40 FrAD.5

Robust Control for Human Postural Balance: Design and Simulation

Kuzmych, Olena Lesya Ukrainka East European National Univ

Awrejcewic, Jan Lodz Univ. of Tech

Aitouche, Abdel CRISTAL/HEI

Bahniuk, Nataliia Lutsk National Tech. Univ

In this paper, an optimal controller for dynamic model describing a system of human postural balance in response to small perturbations is developed. The purpose is to analyze the scientific problem of particular simulating the work of separate parts of central nervous system (CNS) in terms of understanding the ways of its functioning, as well as the application of these knowledge for solving topical and actual issues of biomechanics and mechatronics. In the article the problems of adaptation of control systems methods analysis of human postural balance in a presence of CNS problems are considered. Robust control strategy that describes, as close as possible the role of knee, ankle and hip joints in the human postural stabilization is developed. The proposed control law simulates the ankle joints functioning and minimizes the nervous efforts of the central nervous system, as well as implements the stabilization of the center of mass of a human in the presence of small state perturbations of the body from the position of equilibrium

in the sagittal plane.

10:40-11:00 FrAD.6

Direct Power Control of DFIG by Sliding Mode Control and Space Vector Modulation

MAZOUZ, FARIDA Univ. of Batna 2
belkacem, sebti Univ. of Batna
Colak, Ilhami Gazi Univ
DRID, Said Unversity of Batna

This paper presents a comparative study of two approaches for the direct power control (DPC) of doubly-fed induction generator (DFIG) based on wind energy conversion system (WECS). Vector Control (VC) and Sliding Mode Control (SMC). The simulation results of the DFIG of 5 KW in the presence of various uncertainties were carried out to evaluate the capability and robustness of the proposed control scheme. The (SMC) strategy is the most appropriate scheme with the best combination such as reducing high powers ripple, diminishing steady-state error in addition to the fact that the impact of machine parameter variations does not change the system performance.

FrBA Assembly Hall Nexus Building (ground floor)

Plenary Session III

11:30-12:15 FrBA

Sampled-data and Networked Control Systems: A Time-Delay Approach

Prof. E, Fridman,
Dept. of Electrical Engineering-Systems. Tel Aviv University

Abstract:
A classical approach to sampled-data control is based on discretization, which looses an information on the inter-sampling behavior and performance. To avoid the latter problem, a time-delay approach to sampled-data control was introduced, where the system was modeled as a continuous-time system with the delayed input/output. The time-delay approach became popular in networked control systems, where the plant and the controller exchange data via communication network. In the present talk three main approaches to sampled-data control will be discussed. A recent extension of the time-delay approach to networked-control systems will be demonstrated, where variable sampling intervals, communication delays and protocol scheduling are taken into account. Also event-triggered control will be mentioned

FrCA Assembly Hall Nexus Building (ground floor)

Plenary Session IV

12:15-13:00 FrCA

Vibration control systems with information constraints

Prof H. Reza
Department of Mechanical Engineering. Politecnico di Milano. Milan

Abstract:
The objective of this talk is to review some recent results on vibration control of structural systems with a focus on advanced controller design strategy developments under information constraints. In particular, seismic protection of large building structures will be presented as a case study and some recent results on effective computational decentralized control design strategies with partial local-state information will be addressed accordingly. Finally, some concluding remarks are provided.