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Abstracts of regular Papers

Technical Session 1: Robust control

CS.52 ***A robust Nonlinear Controller Approach of a Wind Energy Conversion System Based on a DFIG.***
Hamdi Hichem, Ben Regaya Chiheb and Zaafouri Abderrahmen

This research document deals with the synthesis of a nonlinear control law for a doubly fed induction generator (DFIG), which aims at improving its performances, robustness, and stability. Several commands have been proposed in literature, among them, the adaptive nonlinear back stepping command based on Lyapunov function. The purpose of this command is to control the electromagnetic torque of the generator while maintaining a reactive stator power equal to zero. This command permits the extraction of the maximum power point, despite wind speed variations. In order to validate the theoretical results, the corresponding algorithm is implemented in MATLAB/SIMULINK simulation environment. The results analysis shows the characteristic robustness of the DFIG using the proposed controller.

CS.60 ***Robust multiple model-based control proposed for a SISO CSTR Benchmark***
Marwa Yousfi, Tarek Garna and Hassani Messaoud

In this paper, robust multiple model-based LSDP (Loop-Shaping Design Procedure) controller is proposed for a SISO, system where each linear submodel is represented in the form of a SISO ARX (Auto Regressive with exogenous input) Laguerre model. The proposed controller guarantees robustness in term of stability and reference tracking of the SISO system in presence of parametric uncertainties. Simulation example on the SISO, CSTR (Continuous Stirred Tank Reactor) Benchmark is given to show the efficiency and the robustness of the proposed, controller in handling the parametric, uncertainties of the process.

CS.80 ***Model Reference Adaptive Control for Temperature Regulation of Continuous Stirred Tank Reactor***
Ahmed J. Abougarair and Nasar Aldian Ambark Shashoa

CSTR (Continuous Stirred Tank Reactor) is a major challenge in process control that has sparked a lot of research in the chemical and control engineering. The nonlinear and coupled nature of CSTR makes designing a robust control with a larger working region difficult. Conventional PID (Proportional Integral Derivative) and adaptive control are described in this work for temperature control. For adaptive control system, the MRAC strategy is utilized and the control law is created by the Lyapunov stability method. Additionally, the robustness and efficacy of the MRAC are confirmed compared with PID controller. The suggested controllers' performance is verified using the steady-state error, time specification criteria and tracking of the reference signal in presence of uncertainty. The simulation results clearly show that the MRAC method provides adequate performance in terms of process functional improvements, and more flexibility, in addition to, improves system-tracking precision in control action compared with the PID.

Technical Session 1: Microelectronics

EM.37 ***Dynamic Characteristics of Normally-OFF Silicon Carbide JFET***
K. Shili, R. Gharbi and Ben Karoui

We propose in this paper the study of the dynamic behavior of the JFET Normally-off based on 4H-SiC (1200V-17A), which depends on junction capacitances between the electrodes. The evolution of these capacitances as a function of the applied voltage shows the non-linearity between these parameters. The dynamic behavior in switching of the JFET has been studied and compared with the results found by simulation using PSPICE. According to the forms of experimental and simulation waves, we have able to extract the switching time: turn-on Ton and turn-off Toff which are low (of the order of 10-6s) and still proves the rapidity of the switching speed of these transistors.

EM.47 ***A Low-Power Maximally-Flat Transconductor in Subthreshold CMOS***
Lazhar Fekih-Ahmed

A new CMOS wide linear range fully differential transconductor is proposed. The transconductor employs 5 unbalanced differential pairs with transistor aspect ratios chosen optimally using Padé-type approximation theory. It achieves a linear range of 86mV for a voltage supply of 1V. The total harmonic distortion does not exceed 2% for peak to peak voltages as high as 0:2V and frequencies as high as 1MHz. Monte Carlo simulations revealed that the linear range of the suggested transconductor is not prone to parameter variations.

Technical Session 2: Communication I

Com.35 ***Energy optimization in a D2D communication based on a fuzzy system***
Anouar Ben Abdennour, Mohamed Ouwais Kabaou and Belgacem Chibani Rhaimi

The work presented in this paper is part of Device to device (D2D) communications in 5G network. Attention deals with one of an important key factor conditionning this type of communication. This defines energy conservation parameter in D2D communication. We will first propose an algorithm for energy conservation and connectivity maintaining based on the fuzzy logic approach. This consists on developing a decision support system to choose an appropriate selected relay for the communication. In such manner, one would minimize the energy consumed and consequently the network's lifetime will be maximized.

Com.51 ***Performance analysis of multi-user mixed RF and hybrid RF/FSO cooperative systems with buffers based on GC-LDPC codes***
Ibrahima Gueye, Idy Diop and Ibra Dioum

This article analyzes the impact of the use of error correcting codes, in particular globally coupled LDPC codes (GC-LDPC) in a double-hop relay system composed a multiuser mixed radio frequency (RF) and hybrid RF/FSO (free-space optical). For this configuration, communication between mobile users and a destination is via a buffer assisted decoding and retransmission relay node. Users transmit their data to the relay node over RF links using a virtual multiple input multiple output (MIMO) system. The relay node after decoding the data of all users using two-phase local-global decoding, this data will be transmitted to the

destination via an FSO link supported by an RF MIMO backup system to the destination. A multi-antenna listener listens to information by decoding data received from users. The relay temporally stores user data in its buffer memory until the best channel conditions on the relay destination link are met. For this communication setup, we first suggest using GC-LDPC codes for data encoding and decoding. The numerical results validate that buffering in the physical layer and the use of GC-LDPC codes significantly improve system performance. It is also found that the use of the relay buffer memory, the back-up RF link (in the second hop) and the use of GC-LDPC codes help protect user data against atmospheric turbulence.

Com.58 ***Emotion Recognition using Speech Data with Convolutional Neural Network***
Minh H. Pham, Farzan M. Noori and Jim Torresen

Identifying emotion from speech has a wide range of applications and has drawn special interests in research to improve the human- computer interaction experience. Traditional machine learning approaches usually face the challenge of selecting the optimal feature set for each application. Deep learning, on the other hand, allows end-to-end development of the models and inherent feature extraction. In this study, we evaluate the performance of Convolutional Neural Network on different kinds of spectral features of acoustic signal collections, from two popular open databases Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS) and Berlin Database of Emotional Speech (EmoDB). Two-to-eight classes of emotions (RAVDESS) and two-to-seven classes of emotions (EmoDB) are identified by the deep learning model. The results, in terms of unweighted average recall, are 0.888 (two classes) and 0.694 (eight classes) for the RAVDESS dataset. The corresponding results for the EmoDB dataset are 0.993 (two classes) and 0.764 (seven classes)

Com.65 ***Impact of hot carrier on RF N-LDMOS reliability for radar application after pulsed life test***
Mohamed Ali Belaid and Mohammed Almatrafi

This Study presents a bench is dedicated to high RF power device lifetime tests under RF pulses for radar application. This bench combined the stress tests (RF, electrical and thermal,) applied to devices and have a direct impact on their lifetime. A complete device electric characterization (I-V, C-V and RF) has been conducted before/after different temperatures (3000 hours at 150° C and 10° C), and material clarifications for the phenomenon of failure, the reliability of different tests was compared. The prevailing physical acoustics concerned were stuied and validated using the Silvaco-Atlas simulator. The main objective is to find a relationship between the electrical parameters degradation to failed physical phenomena caused by impact ionization. The degradation of N-LDMOS performance is tied to the hot carriers (traps) and trapped electrons, which leads to the accumulation of negative charge in the Si/SiO2 interface. More interface states (i.e. important buildup of negative charge) are created at low temperature due to impact ionization phenomenon. This is the reason why the electrical degradations are so high at 10°C.

Com.88 ***FPGA Implementation of Short Frame OFDM System for Sensors Networks***
Lucas Lebailly, Raouia Masmoudi Ghodhbane

This paper focus on the physical layer of a new communication protocol using Orthogonal Frequency Division Multiplexing (OFDM), and its implementation on FPGA mock-up for pressure and temperature sensors application. We implement the design of the OFDM

transmitter and receiver blocks. We present an aeronautic sensors application in which a Power Line Communication (PLC) for sensors networks based on OFDM is implemented on FPGA. We show a laboratory test between FPGA connected to several pressure and temperature sensors; and a computer displaying a graphical user interface (GUI).

Technical Session 2: Predictive control

CS.28 ***Robust predictive control for uncertain nonlinear MIMO systems based on MISO Volterra expansion on generalized orthonormal bases.***
Tarek Garna, Achraf Jabeur Telmoudi and Hassani Messaoud

This paper proposes a new robust predictive control for uncertain nonlinear MIMO systems based on a set of MISO submodels where each is modeled by the 2nd order MISO-GOB-Volterra model, the coefficients of which belong to an orthotopic parameter uncertainty set (PUS). We present the general form of a new predictor and so, we propose an optimization problem formulated as a quadratic programming (QP) under linear and nonlinear constraints with respect to parameter uncertainties. The efficiency of the proposed multivariable robust predictive control approach is validated on an experimental Communicating Two Tank system (CTTS) considered as Two-Input and Two-Output (TITO) system.
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CS.36 ***Decoupled Multimodel Predictive control for Discrete-Time Nonlinear Singularly Perturbed System***
Asma Ben Rajab, Nesrine Bahri and Majda Ltaief

The present paper deals with a multimodel predictive control for discrete-time nonlinear singularly perturbed systems based on decoupled multimodel structure. For each local model a partial predictive control is synthesized. the weighted sum of these partial controls gives the global control law to be applied to the nonlinear singularly perturbed system. An algorithm is established to synthesize the adequate multimodel predictive control which guarantee to the system the closed loop desired performances. Simulations results are presented to illustrate the effectiveness of the proposed multimodel predictive control strategy.

CS.45 ***Design and control of an Upper-Limb Orthosis Simulator for a passive rehabilitation***
Hmaied Hmida, Sami Hafsi and Faouzi Bouani

This paper presents the design and the position control of a robotic rehabilitation didactic system. This robot is an upper limb device simulating the passive rehabilitation of a human elbow joint. The limb dynamic is unknown and differs from one patient to another so only the model of the orthosis robot is identified. Then, experiments were performed without load and three controllers are designed. A comparative study between predictive, PI and RST controllers is established in a real time environment. This comparison highlights the effectiveness of the model predictive controller.

CS.71 ***Fractional Predictive Control of Multi-Input Multi-Output Systems***
Chouaibi D. and Chagra W.

Considering the fact that most of physical processes have MIMO models and the fact of fractional order model sability in accurate representing real plants, the aim of the paper is to

realize a model predictive control scheme for MIMO fractional order systems. The developed control algorithm, based on Grunwald-Letnikov method, offers reduced calculation cost which is illustrated through simulation results.

Technical Session 3: Optimization: Techniques and Applications

CS.29 ***Optimization of the energy performance of a hybrid vehicle***
Mourad Ali Salah and Naceur Benhadj Braiek

Parallel hybrid car is composed of an internal combustion engine, a reversible electric machine and a battery. The heat engine is powered by chemical energy stored in the fuel. For vehicle traction, the two machines can operate at the same time or separately. The battery can be charged at the same time with the vehicle's traction or while it is stopped, we speak of hybrid mode with battery charging. One can also take advantage of energy recovery by enumerative braking along a road downhill or / and during a deceleration of the speed of the car. In the event that the vehicle is only towed with the electric machine, this is referred to as pure electric mode. The case where the two machines intervene at the same time to the traction of the vehicle corresponds to the assistance mode. Like the conventional car, the hybrid car can operate in pure thermal mode. In actual operation of the vehicle, the route is unknown in advance. To minimize fuel consumption, the powertrain system must operate instantly at its best fuel efficiency. This work deals with the case where the vehicle route and driving conditions are unknown in advance (real case). In this condition, we propose an optimal control strategy based on instant criterion that we have developed. These allow the maximization of the overall and instantaneous efficiency of the powertrain system of a parallel hybrid vehicle in each mode of operation.

CS.56 ***Vendor-Independent Software-Defined Networking***
Santiago Pagola Moledo, Abhimanyu Rawat and Andrei Gurtov

Software-Defined Networking (SDN) is an emerging trend in networking that offers several advantages such as smoother network management over traditional networks. By decoupling the control and data planes from network elements, a huge amount of new opportunities arise, especially in network virtualization. In cloud datacenters, where virtualization plays a fundamental role, SDN presents itself as the perfect candidate to ease infrastructure management and to ensure correct operation. Even if the original SDN ideology advocates openness of source and interfaces, multiple networking vendors offer their proprietary solutions. In this work, an open-source SDN solution, named Tungsten Fabric, is evaluated in a virtualized datacenter and several SDN-related industry use-cases are examined. The main goal of this work is to determine whether Tungsten Fabric can deliver the same set of use-cases as proprietary solutions.

CS.90 ***Enhancing logistics operations sustainability through resource sharing: The case of French agri-food SMEs***
Aymen Aloui, Nadia Hamani, Jaouher Chrouta and Laurent Delahoche

In recent years, the implementation of collaborative strategy in logistics systems has become a highly efficient practice to realize economic as well as environmental benefits. Traditionally, the collaborative logistics network design problem is based on classical and independent models where each planning decision is made separately. This study presents and solves an integrated and collaborative two-echelon location, inventory and routing

problem to design sustainable distribution networks. Due to the NP-hard nature of the investigated problem, a two-stage heuristic approach is developed to deal with large real-world problems. To assess the performance of the proposed approach, a comparative study of the obtained results with those obtained by the CPLEX solver is performed. The comparison results demonstrate that the heuristic approach is very efficient in terms of computation time and solution quality. In addition, a real case study in the French agri-food sector is discussed to analyze the sustainable gains of the proposed approach. The findings reveal that cooperation in integrated decision management can significantly reduce emissions, accident risk as well as logistics costs.

CS.103 ***The Solutions of Two Dimensional Finite Square Well Potential Problem Using the Finite Difference Time Domain Method***

Amal Hamed, Huwaida K. Elgweri and Mohamed Mansor

We calculate the numerical eigenfunctions and their corresponding energy eigenvalues of the higher excited states for two dimensional finite square well potential, by solving the Schrödinger equation using the finite difference time domain method (FDTD). The iterative procedure involved in this method was improved using symmetric arguments to calculate the lower angular excited states, and we extent this improved method to calculate any excited state directly using suitable initial guess wave function that is close to the desired excited state. This suitable initial guess wave function is calculated analytically using the separation of variables technique. In this paper, our calculations include two essential parts. First, in order to confirm the applicability of the separation of variables technique, we compare the lower states, namely, the ground state, the first angular excited state and the second angular excited state, were calculated by using this technique with their corresponding numerically exact states. Therefore, we can consider the solutions of the separation of variables technique as a semi-analytical approximation. Second, we take advantage of this approach to get any desired excited state directly if it exists.

CS.109 ***Impact of Graph Compression on Solving the Two-Dimensional Strip Cutting Problem***

Mehdi Mrad, Tamer G. Ali, Ali Balma, Anis Gharbi, Ali Samhan and Mohamed Aly Louly

We address the problem of cutting a set of m rectangular items from a two-dimensional strip of width W and infinite height. Each item has a given width, height, and demand. The objective is to minimize the height of the used strip, while respecting the two stages of guillotine cuts. This NPhard problem is referred to as the two-dimensional strip cutting problem. We consider the arc-flow formulation of this problem and propose to enhance it using graph compression techniques. Experimental results on a set of real-world instances show a consistently promising impact of the graph compression in terms of computation time and graph size.

Technical Session 3: Surveillance, Fault detection and Diagnosis

CS.31 ***Robust stabilization and Fault Tolerant Control for uncertain singular neutral variable time delay systems***

R. Benjemaa, A. Elhsoumi, S. Bel Hadj Ali Naoui and M.N. Abdelkrim

The main goal of this work is the robust stabilization and the design of fault tolerant control to achieve the desired performance in the closed loop system. The studied system is an uncertain singular neutral variable time-delay. First, H∞ controller is developed to guarantee robust stabilization of the closed loop system. Then, an adaptive observer is designed to achieve the fault and state vector estimation. Finally, simulation results are presented to prove the theoretical development.

CS.46 ***Zonotope based Fault Tolerant Control for Discrete-Time Linear Time-Invariant Systems***
Leila Dadi, Haifa Ethabet and Mohamed Aoun

This paper considers Faut Tolerant Control (FTC) problem for discrete-time Linear Time-Invariant systems (LTI) affected by faults on actuator. First, zonotope-based interval estimation technique is proposed, which integrate robust observer design with zonotopic analysis. By introducing $H\infty$ performances in the observer design, the designed technique reduces the effects of uncertainties and improve the interval estimation accuracy. Based on the robust designed observer, the interval state estimation can be realized via a zonotopic analysis. Second, a FTC is designed to stabilize the close-loop system subject to actuator faults. The control law design is based on zonotopic technique, guaranteeing closed-loop stability. Simulation results are provided to illustrate the performance of the proposed method.

CS.118 ***Detection and Localization of a Supply Voltage Unbalance Using an Improved Park Lissajou's Curves Approach***
Samira Ben Salem, Neila ouerghemmi, Khmais Bacha and Abdelkader Chaari

In this work a fault signature based on the Park Lissajou's curve is suggested. It was applied to an induction machine driving a centrifugal fan, that operating in various industrial systems. We propose a new index extracted from Park Lissajou's curve for the detection and localization of unbalanced voltages. In fact, the range ratio is determined to distinguish the two states; normal (balanced voltage) and faulty (unbalanced voltage). The ellipse orientation angle α is calculated to differentiate between the unbalance in phases B and C. This approach is simple, it shows its effectiveness and its robustness in detecting and localizing of studied fault.

CS.119 ***V-belt Fault Detection using Motor Current Signature Analysis in Centrifugal Fan System***
Neila ouerghemmi, Samira Ben Salem, Khmais Bacha, Abdelkader Chaari

Asynchronous drives are widely used in many industrial applications because of their low cost, high performance and robustness. However, faulty operations may appear during the lifetime of the system. This paper deals with the use of motor current signature analysis (MCSA) as a diagnostic technique for the influence of Vbelt drive faults on three-phase induction motors. For this purpose, we create faults on the belt such as axial misalignment and side-cut-off fault.

Technical Session 4: Artificial Intelligence and IoT

CS.26 ***A Learning Rate for MIMO Nonlinear System Emulation***
Farhat Yassin, Atig Asma, Zribi Ali and Ben Abdennour Ridha

This paper presents an emulation scheme based on a novel method to adjust the learning rate for multivariable nonlinear dynamical systems. The aim of this paper is to adapt the learning rate of the Neural Emulator (NE) in order to accelerate the convergence speed and to improve the precision degree. To ensure fast convergence and good estimation, an online adaptation is developed using a criterion generated by the error of emulation. The obtained results prove the efficiency of the designed NE compared to those obtained with an existing one using a fuzzy supervision. This paper presents an emulation scheme based on a new approach to update the learning rate for multivariable nonlinear dynamical systems. The aim of this paper is to update the learning rate of the Neural Emulator (NE) in order to accelerate the convergence speed and to improve the precision degree. To ensure fast convergence and good estimation, an online adaptation is developed using a cost function generated by the emulation error. The obtained simulation results show the efficiency of the proposed strategy compared to those obtained with an existing one based on a fuzzy supervision.

CS.34 ***An Electric Wheelchair Monitoring System based on the Internet of Things and Fog computing***
Hafedh Ben Hassen, Nadia Ayari, Ahmed Maalel and Belgacem Hamdi

Disabled persons and the elderly face many problems in their daily lives. Mobility is one of the most common of these problems. Electric wheelchairs are among the most frequently used devices to help them navigate. However, safety remains one of the biggest problems for these wheelchairs. This paper proposes an electric wheelchair monitoring system based on the Internet of Things (IoT) and Fog computing to provide safety for the users. This system was developed using the NodeMCU V3 IoT platform and an Android app that plays the role of Fog server, which allows users to monitor the ambient climate factors and the battery level, communicate with healthcare providers, and receive notifications and recommendations if there is a risk. Through evaluation, most potential users of this system consider it easy to learn and use, suggesting that our proposal can improve the safety of wheelchairs users.

CS.78 ***Adaptive neural network PID controller for nonlinear systems***
Ramzi Bouzaiene, Sami Hafsi and Faouzi Bouani

In this paper, we are interested in adaptive neural PID control with a reference model for nonlinear systems. A recurrent neural network architecture is studied, and its parameters are computed to mimic a conventional PID controller. Two neural networks architectures, Feed Forward Neural Network (FFNN) and Recurrent Neural Network (RNN) are used for modeling nonlinear systems. To avoid the errors of the Jacobian system approximation, it is best to model the system with a neural network called an emulator. By adding an emulator in parallel with the dynamic system model, the emulator will be trained to learn the dynamics of the system. The back-propagation method is used as the basis for developing algorithms capable of modeling and controlling our nonlinear systems.

CS.99 ***ANFIS vs Scalar control which solution to choose ?***
Siwar Bellahirich, Dhafer Mezghani abedlkader Mami

Like most multidisciplinary automatic systems, pumping process need controllers to boost their performances. The main problem confronting specialists is which controller is most suitable for the application in question. For this purpose, a comparative study is presented in

this work showing the importance of combining scalar and ANFIS respectively archaic and new intelligent technologies in favor of the designed architecture development.

CS.129 ***Cooperative multi-swarm particle swarm optimization based on adaptive and time-varying inertia weight.***
Sami Zdiri, Jaouher Chrouta, Abderrahmen Zaafouri

Optimization of particle swarms is a stochastic optimization method based on swarm intelligence applied in many fields of endeavor to solve technical, scientific and economic problems. Due to its ease of application, it has gained great importance in recent years. As the swarm may lose its diversity and lead to premature convergence, it is very easily trapped in local optima. To solve this problem, we propose, in this research work, a cooperative multi-swarm particle swarm optimization algorithm called cooperative multi-swarm particle swarm optimization (CMsPSO). The introduced algorithm divides the entire population into four cooperative sub-swarms with an adaptive and time varying inertia weight. The particles of each sub-swarm share the best overall optimum to ensure the cooperation between the four sub-swarms. On the other hand, the adaptive and time-varying inertia weight is used to create search potential and effectively maintain a balance between the local research (exploitation) and the global (exploration). To show the efficiency of the developed C-MsPSO algorithm, several uni-modal and multimodal benchmark test functions are considered. The introduced algorithm demonstrates surprising efficiency and precision in identifying the optimal solution. The experimental results reveal that C-MsPSO outperforms the other PSO algorithms on twelve reference functions.

Technical Session 4: Modeling and control design methods

CS.22 ***Modeling and regulation of the internal climate of an agricultural greenhouse:***
Tanazefti Asma, Haddouk Amira and Mechergui Hfaiedh

This paper presents the modeling and control of the indoor climate of greenhouses. Indeed, in order to predict the internal climatic parameters of an agricultural greenhouse such as air temperature and relative humidity, it is necessary to model the greenhouse using Matlab / Simulink software. This model describes the transfer of heat and water vapor inside the greenhouse as a function of weather conditions (wind speed, outside temperature, solar radiation, outside humidity, location and structure of the greenhouse, season, etc. etc). Consequently, the all-or-nothing (TOR) regulation has been adapted to the greenhouse model in order to regulate the temperature and humidity of the soil to a precise set point. When the plant's water and ventilation needs reach a well-defined threshold, usually chosen by the farmer, the TOR regulator sends the control signals to the solenoid valve to start the irrigation and also to the fan to cool the indoor climate of the greenhouse.

CS.69 ***Modeling and Optimal Classical Control of Blending Tank Level System in Cement Plant***
Abraham Amole, Daniel Akinyele Oluwatosin Aina and Olakunle Olabode

Optimal material level control in blending tank can be achieved through the use of a PID controller. However, the major challenges of PID controller are high overshoot and steady-state error, prolong settling time, and slow response which practically causes wastages and equipment downtime. Thus, in this work classical techniques were employed to tune PID controllers to achieve optimum performance of the blending tank level control. The mass

balance principle was used to model level of the blending tank while Zigler-Nichols (ZN), Chien- Hrones-Reswick (CHR), and Cohen-Coon (CC) techniques were used to tune the PID controller for optimal performance. The performance of the simulated control schemes MATLAB/Simulink were evaluated using rise time, settling time, peak amplitude, and overshoot. The results revealed that the ZN-PID controller gave the lowest rise time of 2.11s, settling time of 14secs, and peak amplitude of 1.04 while the lowest overshoot of 0% was achieved by both CHR and CC-PID. It can be inferred that ZN-PID gives the best way of controlling the level of the blending tank.

CS.85 ***Multi-trip Vehicle Routing Problem with pickup and delivery and temporal constraints: Case of a sterilization center in a multi-hospital network***
Ons Saidi, Alfonso-Lizarazo, Malek Masmoudi, Pascal Albert, Koffi Cobbold

In this paper, we deal with the configuration of transportation services in the context of centralization of sterilization service for a multi-hospital network. The objective is to design logistics trips between the network of hospitals and the sterilization center to pick-up contaminated reusable medical devices and distribute sterile ones while minimizing the transportation costs. The problem is addressed as a Multi-trip VRP with pickup and delivery, with temporal constraints such as time windows and release dates. We propose a mixed integer programming model and provide numerical experiments on randomly generated instances. A sensitivity analysis regarding several parameters is provided and the performance of the proposed model is shown.

CS.115 ***Dynamic Modeling and Identification of Two-link robotic manipulator with a Friction Model Depending on Load and Temperature***
Mouna Dali Hassen, Imen Laamiri and Hassani Messaoud

Frictional losses within the transmission components of robotic manipulators are often modeled as a constant Coulomb friction force or/and a viscous friction force proportional to the sliding velocity. However, the variation in contact forces of lubricated surfaces of the mechanical transmission system influences the friction force. The joint temperature also has an effect on the variation of the latter. Hence, the importance of considering the parameters mentioned in the dynamic model of the robotic manipulator. This paper presents a new load and temperature dependent model that will be subsequently identified from experimental measurements carried out on robotic manipulator joint with different loads.

Technical Session 5: Power systems

PS. 41 ***DTC-SVM Control for Induction Motor Drives Fed by Sparse Matrix Converter***
Abdessami Soyed, Ameni Kadri, Kamel Sahayi, Othman Hassnaoui and Faouzi Bacha

This paper proposes a space vector modulated direct torque control strategy for induction motor drives fed by a three-phase Sparse Matrix Converter (SMC). For the rectifier stage, a space vector modulation strategy is employed. For the inverter, a direct torque control method with a fixed switching frequency is proposed. The performance of the proposed drive system is evaluated by numerical simulation using Matlab-Simulink environment. The simulation results are used to verify the effectiveness of the proposed strategy and support the analytical results.

PS.87 ***Voltage Oriented Control of Three Phase Bidirectional AC/DC Converter***
Faouzi Tlili and Faouzi Bacha

This paper describes a famous control strategy dedicated to the three-phase bidirectional AC/DC converter called Voltage Oriented Control (VOC). The proposed technique is based on measuring the voltages and currents of the electrical grid in a first phase. Then, the decoupling between the direct current component and the quadrature component of the current, obtained via the Park transform (d-q), will be ensured by what is called feed-forward flow control. The latter is equivalent to using PI controllers. Finally, in order to establish the desired performances, the simulation will be visualized by the Matlab/Simulink environment.

PS.108 ***Impact of the MMC level number to reduce THD rate and improve the power quality transmitted to the electrical grid***
Mansour Baazouzi and Faouzi Bacha

The High Voltage Direct Current (HVDC) power systems has an important role in transmitting high power among long distances with respect to the transportation of the AC high voltage (HVAC). The HVDC grid has a set of advantages such as robustness against disturbances and low power losses compared to the AC system and the connection between two AC power grids. Modular Multi-Level Converter (MMC) is more suitable kind of topology compared to other topologies used in HVDC applications. The increasing number of submodules (SM) presents a challenge for researchers in terms of ordering complexity. In this paper, two pulse width modulation techniques are compared in the quality of currents and voltages to the filter level, which presents one of the major problems of the MMC converter. The simulation was performed using MATLAB/Simulink software and the presented simulation results prove the performance of the proposed control systems. The output voltage waveforms and the total harmonic distortion (THD) rate of the proposed system are improved without the need for a filter.

Technical Session 5: Robotics and Modeling Systems

CS.66 ***Analysis and Control of the Dynamic Walking of the Compass Biped Walker Using Poincaré Maps: Comparison Between Two Design Approaches***
Wafa Znegui, Hassène Gritli and Safya Belghith

This work aspires to investigate and control the human-like passive walking dynamics of the compass-gait biped walker (CGBW), in order to provide further insights into the human walking mechanism and design energy efficient control laws to stabilize it. We first analyze the impulsive hybrid nonlinear dynamics (IHNLD) model describing the walking process of the CGBW. Such dynamics exhibits complex behaviors, which inhibit the walking process and provoking hence its fall. The idea behind controlling this human-like biped robot returns to stabilize its passive walking with a minimum of energy. Our strategy is based on linearizing the complex dynamics of the CGBW around a period-1 passive hybrid limit cycle (p1-PHLC). Based on Taylor series approximation, we design two different explicit analytical expressions of the Poincaré map (PM). We provide also an expression of the Jacobian matrix for investigating the stability of the period-1 fixed point of the designed PMs, and also for designing the control law. In order to accomplish our goal concerned with the control of the biped robot, we design later two explicit expressions of the controlled Poincaré map (CPM). For each expression, we develop first the linearized CPMs around the period-1 fixed point of the PMs and we adopt a state-feedback control law to stabilize it. For each expression of the

CPMs, we adopt an LMI-based optimization approach by considering the CPMs to design the feedback gain. Finally, we illustrate some simulation results in order to validate our methodology towards control of the CGBW using the PM approach.

CS.91 ***Flow-Loop Testing of Online Oil-in-Water UV-Fluorescence-Based Measurement***
Stefan Jespersen, Dennis S. Hansen, Zhenyu Yang and Simon I. Andersen

The online monitoring of Oil-in-Water (OiW) concentration in dynamic flow-loops using UV-Fluorescence-basedsensors is investigated. Though the OiW sensors can be carefully calibrated in the static condition, many dynamic flow conditions can still impact their real-time measurement. In order to examine the considered OiW sensor's capability in handling dynamic flows, an extensive experimental study has been committed, which considers the following aspects, such as (i) different flow-loop configurations, e.g., standalone-loops and cyclone-in loop; (ii) different online sampling mechanisms, e.g., (direct) inline measurement and (indirect) side-stream measurement; (iii) different flow-rates of total stream or side-stream under different configurations and sampling mechanisms; (iv) impacts of air bubbles and pressure-pumps. The experimental results show that the considered OiW sensor can provide quite reasonable dynamic measurements in general. However, this sensor's measurement can be very sensitive to different flow regimes, impurities (incl. air) in the measured stream as well as upstream (nearby) operating conditions. These observations could inspire automation researchers and industrial operators to create some innovative sensor fusion method(s), to combine this OiW measurement with other available measurements in the produced water treatment processes for better control of the de-oiling hydrocyclone system.

CS.98 ***Track the finger movements of the human hand through the smart camera to control the Allegro Hand robot.***
Naji guedri and Rached Gharbi

Gestures are one of the richest ways of communication that humans have. Therefore, automated hand detection and finger behavior are some of the most compelling challenges in robot vision. Recently, many ideas and technologies have been used in programming to use cameras to recognize the fingers of human hands and apply them to robots. In this paper; the innovative algorithm is based on intelligent ideas and mainly relies on image analysis after camera shooting. In order to identify the fingers of the hand by a camera, the idea is to assign each finger to a percentage in pixels of the binary image, which represents the area of the finger. Each ratio compares to the live image to determine which fingers the user has chosen to control the Allegro Hand robot. Also in this work, the hand can move freely in front of the camera, relying on a new idea of measuring the distance between the hand and the camera. We use for this a small ticket in geometric form square and color different to black and white. This ticket is affixed to the back of the user's hand and through which we can know the size of the hand, regardless of the distance on the Z-axis of the image. This is important in determining the proportions of the fingers according to the distance from the camera. The camera is here combined with a hand human and Allegro Hand to ensure more interactive communication, harmony and easier. The result of the smart camera is tested with multiple experimental trials with a robotic hand. Many finger positions were identified correctly in front of the camera.

Technical Session 6: Photovoltaic Systems

PS.40 ***Overview and comparative of maximum power point tracking methods of PV power system***
Fethi Messaoudi, Fethi Farhani and Abderrahmen Zaafouri

The demand of PV energy is constantly increasing as renewable and clean energy. But this energy has a challenge such the gain on power in order to improve its efficiency. For this challenge, MPPT methods are obligation in the field of PV system to maximize power output and ensure conversion efficiency. The most common problems associated with MPPT methods are low tracking efficiency, which require more transient time and steady state of oscillations. This paper presents a summary of the widespread MPPT methods with rigorous classification. Also, a comparative recapitulation is made via well-chosen criteria so that the researcher makes the right choice of the appropriate MPPT method.

PS.62 ***Shading effect on the performance of a photovoltaic panel***
Gharbi Abdelaziz, Ben Regaya Chiheb and Gharbi Rached

Photovoltaic modules are very sensitive to the reduction of solar irradiation due to shading. Shading can be caused by a fixed obstacle (wall, tree or even a simple pillar) or in case of circumstantial events (cloudy sky or covered with heavy smoke or dust). In order to illustrate the influence of shading on the behavior of a photovoltaic device, a study using MatLab Simulink was carried out on a polycrystalline silicon module YL250P29. The degradation of the incident solar irradiation on a single cell of the photovoltaic panel leads to a considerable decrease in the power produced by the system (about 1/3 in the case of a fully shaded cell). We have monitored the behavior of the bypass diode, and the pivotal role it plays in preserving the series of cells adjacent to the affected one and ensuring a reasonable rate of output.

PS.64 ***Performance comparison of DC-DC Converters for Photovoltaic System***
Belgacem Mbarki, Jaouher Chrouta, Fethi Farhani and Abderrahmen Zaafouri

The maximum power point tracking techniques are used to fully exploit the power output of the photovoltaic panel. This power always varies with the Photovoltaic solar irradiation and the atmospheric temperature. However, with the progress of power electronic equipment, solar panels may now be operated at their maximum power point, increasing total Photovoltaic system efficiency. Simple and Quadratic boost converters are simulated and the results are compared in this study. Then, the MPPT technique based on Incremental Conductance is proposed to improve the efficiency of the Photovoltaic system. For dynamic solar irradiance and temperature, the suggested technique's performance is simulated using MATLAB/Simulink. The analysis is based on two systems that use different DC-DC converters.

PS.110 ***Advanced nonlinear method of a Photovoltaic system connected to the single-phase network***
Ilhem Bouchriha, Ali Ben Ghanem and Khaled Nouri

This paper presents a nonlinear method advance of a photovoltaic energy chain connected to single-phase network via a single-phase inverter with a filter LCL. In this work, we try to achieve three objectives of control: (i) the voltage supplied by the photovoltaic panel(PV)

must be follow the point of maximum power (MPPT), (ii) the voltage across the coupling capacitor must be regulated to ensure the transfer of energy between the two parts, (iii) the current supplied to the network must have a sinusoidal shape and in phase with the grid voltage. To achieve these objectives, we use a nonlinear method based on sliding modes and stability in Lyapunov's sense as tools mathematics for the design of regulators. The simulation results were carried out in the environment Matlab/Simulink. They show that regulators designed achieve their goals.

PS.114 ***Hydrogen Production Station Using Solar Energy***
Slah Farhani, Haytham Grissa and Faouzi Bacha

Conversion of solar energy to hydrogen has been identified as a viable solution for renewable energy development known as solar fuel. In this article, electric models for a proton exchange membrane (PEM) electrolyzer and a solar panel are used to develop a Simulink diagram. I-V characteristics for a single PEM electrolyser cell and solar photovoltaic are modeled in steady state and produced using an equivalent electrical circuit. The design of a Photo-Voltaic system to generate the electrical energy required to produce 25 kg of Hydrogen per day highlights the potential future of green hydrogen produced from solar energy using photovoltaic systems. This hydrogen gas power station requires the installation of PV system to produce of electrical energy per day to run the Proton Exchange Membrane electrolyser during 5 hours per day. The produced hydrogen can be used to charge fuel cell vehicles, generate electricity for buildings during in the night or transported to be consumed in any other industrial applications.

Technical Session 6: Vehicular applications

CS.30 ***Sliding mode control of a Marine Current Turbine driven DFIG-DC conversion system***
Yosra Smai, Hechmi Ben Azza and Mohamed Jemli

This paper presents a marine current turbine (MCT) system based on a Doubly Fed Induction Generator (DFIG) connected to DC-bus. Field Oriented Control (FOC) is the control strategy chosen for the DFIG-DC energy conversion system. In this topology, a diode rectifier is used to connect the stator of the DFIG and the DC-bus, while the rotor is connected to the DC-bus through a PMW inverter. The regulation of the stator frequency and the dc voltage is ensured respectively through the control of d-axis and q-axis rotor currents. First order sliding mode controllers are proposed to control the rotor currents. Simulation and experimental results are presented to show the performance of the proposed control strategy.

CS.38 ***Improved current Control of Floating Interleaved Boost Converter Dedicated to Vehicular Applications***
Nassira Barhoumi, Hajer Marzougui and Faouzi BACHA

This paper investigates the performance of four-phase Floating Interleaved Boost Converter (FIBC) for vehicular applications. For such applications, current control is indispensable in order to ensure the vehicle power (eventually the current) requirement satisfaction. For this reason, two methods are applied in this work to control the current of the source associated to the studied converter which is a fuel cell in our case. This first method is based on using one current control loop which allows to maintain the total current in the output of the source equal to its reference. The second method consists on improving the first one by applying a

current control loop for each converter leg (i.e using four control loops). This converter offers improved efficiency and voltage gain, while ensuring lower input current ripple than other DC-DC boost converter topologies. In this paper, the proposed controls are evaluated for the same road conditions by applying the New European driving cycle (NEDC). Simulation results are presented to validate the effectiveness of the two adopted controls and prove the improvements presented by the technology using four control loops.

CS.39 ***Rule-Based power sharing strategy for a fuel cell-supercapacitor vehicle***
Hajer Marzougui, Ameni Kadri and Faouzi Bacha

To meet increasing demands for fuel, alternative vehicles have been developed recently. Electrical hybrid vehicles are one of these alternatives and an important part of them is their energy storage systems which are used to relieve the main source which is generally a fuel cell. To ensure energy storage, the supercapacitor is considered as an interesting device because of its high power density compared to batteries. The hybridization of the main source with another source like energy storage device allows to improve the dynamic response, especially, during transient states. However, it will be necessary to apply an energy management strategy to share the energy flow between sources responding to load demand. Besides, the proposed energy management algorithm must allow us to ensure optimum hydrogen consumption. In this context, this paper deals with an energy management strategy which is based on deterministic rules. Thus, it is called rule-based strategy and it is used to share the power flow in a hybrid electric vehicle powered by a fuel cell and a supercapacitor. Simulation results under Matlab-Simulink environment prove the efficiency of the proposed energy management algorithm.

CS.79 ***STATCOM/APF Control Using Two Proposed DPC Strategies For Power Quality Improvement***
Kamel Sayahi and Bacha Faouzi

In order to provide electrical energy to consumers in compliance with international standards, electrical energy operators are required to control the quality of this energy from its production to its consumption. For this purpose, several static converters are installed at different grid locations to ensure the transient and permanent stability of a novel framework related to the fault diagnosis strategy merging quantitative and qualitative reasoning is the main concern of the later. FACTs (flexible alternative current transmission systems), active power filters... are based on static converters. These devices ensure the compensation of the reactive power in the grid as well as the elimination of the grid current and voltage harmonics. This paper deals with the direct power control (DPC) of a static power converter installed on the electrical network in two different ways. This converter provides the function of a STATCOM (static compensator) of reactive power and at the same time the function of an active power filter (APF).

Technical Session 7: Energy technologies

PS.18 ***Electrical Distribution Architecture and Load Curves Analysis of Audiovisual System:***
Saidi Mohamed, Cherif Habib, Hasnaoui Othman and Belhadj Jamel

This paper presents an in-depth investigation of the load curve of Tunisian television as well as the power system distribution architecture. The proposed system is based on six

transformers, three diesel generators and a park of batteries. The load curves analysis and the energy consumption are discussed. This is an effective tool for carrying out the studies and planning necessary to reduce the electrical energy consumption. In order to classify the loads, the electrical energy consumption is divided in two ways: 1) sensitive loads and 2) normal loads. Real-time measurements of consumption, during four seasons were carried out. As analysis results of sensitive and normal loads, it is recommended to use led lamps for lighting, to integrate a renewable energy production system and to set up an intelligent manager of loads.

PS.44 ***Energy management based fuzzy-logic of a reverse osmosis desalination powered with hybrid system***

Abir Zgalmi, Amine Ben Rhouma, Habib Cherif and Jamel Belhadj

Reverse osmosis desalination systems powered by hybrid renewable source have attracted more and more interests due to the rapid economic growth which increase the human's resources demand especially natural resources. This study aims to propose a real time energy management control strategy for achieving a stand-alone hybrid power reverse osmosis desalination system goal. The hybrid power desalination system comprises: a photovoltaic generator and a wind turbine as renewable sources coupled with a three motor-pumps and three tanks for water storage. These system components are modeled with a particularity of a single sizing parameter between the desalination motor-pump and the reverse osmosis process. The developed energy management strategy is based on fuzzy logic method. The proposed water/energy management strategy is able to satisfy the load consumption profile and to manage the generated power between the different subsystems depending on the variation of the wind and solar radiation and the state of the three tanks. A dynamic simulator with one-hour acquisition using real meteorological and water consumption data for one year of a southern Tunisia site is developed to treat the PV/Wind reverse osmosis desalination unit coupled with the energy management system based on fuzzy logic strategy. The proposed smart power energy management method led to encouraging results.

PS.75 ***Left invertibility of hybrid dynamical systems: a framework for flying capacitor multilevel converters***

Sana Othman, Lassaad Sbita, Jean-Pierre Barbot, Mohamad Alaa eddin Alali and Malek Ghanes

In this paper, we suggest a hybrid observer consisting of a DC-DC Flying Capacitor Multilevel Converter (FCMC)with unknown discrete state. This proposed system consists of a dc-link, 4-level converter with an RL load. The state vector of the considered class of switched linear system presents unobservable modes. An observability concept known as (Z(TN)- Observability) is used to solve such problem. Following that, a hybrid observer is designed based on a coupling between a continuous and discrete observer. Indeed, this approach assumes that the available variables such as the output measurement and the estimated continuous state allow the reconstruction of the unknown discrete state which permits to detect a delay time or a produced default in these states. Finally, to validate this method some simulation results are given in order to show the effectiveness of the proposed system.

PS.81 ***Modeling switched behavior to monitor energy based dynamical systems***
Dhaou Garai, Rafika EL Harabi and Faouzi Bacha

Nowadays, a wide number of manufacturing systems are usually coupled discrete and continuous dynamic behaviors. This paper deals with the design of a novel framework related to the fault diagnosis issue merging quantitative and qualitative reasoning so as to accurately monitor several fault kinds affecting such hybrid systems. Two different structural fault diagnosis approaches are compared. Firstly, the Hybrid Bond Graph (HBG) representation (quantitative way) is used to obtain the Global Analytical Redundancy Relations (GARRs) dedicated to Fault Detection and Isolation (FDI) tasks. Secondly, the qualitative approach utilizes the possible conflicts which are deduced from the Directed Behavioral Hypergraph (DBH) description and able to study the temporal and qualitative impacts related to sensor and actuator faults. Afterwards qualitative and quantitative methods are compared and discussed so as to analysis the ability to diagnose the dynamical hybrid systems.

PS.117 ***Assessment of Induced Potential on Metallic Pipeline Located Nearby to EHV AC OHTL***
Ahmed S. AlShahri

Utility pipelines are often laid in parallel with overhead high voltage power transmission lines (OHTL). Induced potential on the pipeline due to the electromagnetic coupling (EMC) effect can reach dangerous levels, resulting in potentially unsafe conditions for utility operating personnel and in those areas accessible to the public at large. Such induced potential can exasperate pipeline corrosion and cause undesirable electromagnetic interference on neighboring communication networks. In this paper, a pipeline located close to extra high voltage AC overhead transmission lines (EHV AC OHTL) is studied. In addition, the impact of pipeline location profiles and earth soil resistivity are discussed. The analysis is carried out by using Alternative Transient Program which is the modeling package of Electromagnetic Transient Program Software (ATP/ EMTP).

Technical Session 7: Communication II

COM.57 ***Implementation and Evaluation of the ACE DTLS framework over Internet of Things Devices***
Jacob Johansson, Ali Hassan Sodhro and Andrei Gurtov

Internet of Things (IoT) devices are becoming more advanced and powerful than ever, and the application potential is increasing rapidly. This paper significantly contributes in three ways. First, it modifies, extends and implements the well-known security-driven authorization in a constrained environment-datagram transport layer security (ACE-DTLS) protocol's framework on resource constrained IoT devices in a local network. Second, ACEDTLS framework is compared with the Baseline method by adopting performance indicators for example, power dissipation, PLR, latency, overall network performance and a resource server. Third, radio duty cycles (RDC) are adopted for optimizing the energy efficiency of the constrained IoT devices during CPU processing. Experimental environment was examined with three tests i.e., COAP, COAP+token, and COAP+DTLS by putting router at three main distances (1m, 6m and 12m). It is observed that COAP has less PLR, power drain and latency than COAP+token and COAP+DTLS, while COAp+DTLS shows relatively high latency, power drain and PLR at 6m and 12m distances.

COM.59 ***Authentication and Key Agreement Protocol for Secure Traffic Signaling in 5G Networks***
Vincent Omollo Nyangaresi and Zaid Ameen Abduljabbar

Security and privacy issues in 5G networks center around traceability, desynchronization, impersonation, man in the middle, link ability, message replays among others. Although 5G authentication and key agreement (5G-AKA), Extensible Authentication Protocol AKA (EAP-AKA) and EAP Transport Layer Security (EAP-TLS) have been introduced to boost security in these networks, numerous security flaws have been identified in these protocols that render them vulnerable. As such, there has been extensive research on alternative protocols to address these issues. However, the presented protocols still have many security and performance gaps. In this paper, hash signature based AKA protocol is developed. Its security evaluation shows that it is robust against several 5G attacks. It also has the lowest computation and communication overheads compared with the other related approaches

COM.76 ***A class of reduced-complexity hybrid precoding algorithms for MU-MISO OFDM transmission***
Sander Cornelis, Nele Noels and Marc Moeneclaey

In downstream spatial multiplexing involving multicarrier modulation using a hybrid precoder, several trade-offs have to be made with respect to the hardware complexity of the analog part of the precoder, the computational complexity of the precoders, and the performance of the communication system. Here, A class of hybrid precoding algorithms with reduced computational complexity is presented, that can be used under various hardware constraints. Our numerical results demonstrate that the proposed precoders allow one to trade off complexity against performance.

COM:104 ***Performance evaluation of Pilot-based Channel Estimation for Conventional, Cell-Free, and Small-Cell Massive MIMO networks***
Jamal Amadid and Abdelouhab Zeroual

Massive multiple-input multiple-output (M-MIMO) and network architecture are two technologies that have attracted a lot of attention in recent years. Additionally, an alternative network architecture, known as cell-free (CF), has received a lot of interest. Thus, this paper focuses on the M-MIMO technology, especially, the channel estimation (CE) process for three M-MIMO networks (i.e., the conventional M-MIMO network, the CF MMIMO network, and the small-cell M-MIMO network) operating under the time division duplex protocol. Additionally, we employ the Minimum mean square error estimator (MMSE) to evaluate and analyze the CE process in each network architecture. Besides, the large-scale fading model is also provided. for each network architecture, we developed the normalized mean square error formulation for the MMSE estimator. Moreover, we propose a pilot assignment strategy for CF M-MIMO network. We display the numerical results to assert our theoretical expressions.

COM.100 ***OIL-VCSEL-Based Microwave-Photonics Transceiver for a Millimeter-Wave Fronthaul***
Mikhail E. Belkin and Leonid Zhukov

We propose a new solution to design a microwave photonics transceiving hardware for fifth-generation telecom systems of combined Radio-over-Fiber architecture that are considered

as a very promising approach for millimeter-wave mobile front hauling, in particular for prospective fixed small cells in metropolitan areas and moving cells in high-speed railways. The contribution describes the layout of the transceiver under study that uses optically injection locked LWVCSEL simultaneously operating as direct modulated laser and resonant cavity enhanced photodetector, and the results of its experimental investigation to characterize the static and dynamic features in free-running or optical injection-locked modes, and small-signal gain vs RF frequency characteristics for downlink and uplink channels.

Technical Session 8:

COM.61 Investigation the Performance Effect of QOS in MPLS-TE Network
Kenz A. Bozed, Ahlam Mohammed Elbeskri, Jazia R. Ali Zreg and Amer R. Zerek

Due to the need for different communication types (Voice, video, and data) over the network, vendors improving enterprise networks for this purpose to minimize delays in order to support the better result, some applications like voice considered real-time applications which suffer from delay, jitter and packet losses. This paper discusses comparison of QoS performance between three QoS algorithms (PQ, FIFO, and WFQ), when using MPLS-TE technology considering the VoIP QoS parameters (end to end delay, jitter, and packet loss, as simulation done by OPNET modeler 14.5.

COM.73 ***Design of a Modular System for Measurement of Ambient Environmental Parameters MSMAEP for indoor environment quality assessment***
Mehdi Hadj sassi, Asma Karoui, Mounir Ayadi and Isam Shahrour

Nowadays the conditions of interior comfort in a workspace has become a serious matter. On the one hand by the owner of the space but above all for his occupants. The question of working conditions takes, now, into counts indoor environmental quality (IEQ). This the question of interior comfort conditions also arises in the field of higher education. Indeed, the teaching conditions differs from one method to another, meaning that the configuration of a classroom, the student's number and dispatching varies depending on the method used to teach [1]. The main goal of our work is to express and define the comfort in a classroom, depending on the occupant activity, using infield measurement and occupant feedback. This will lead us to know if the local regulation regarding the comfort is in adequation with the real perception of comfort. To achieve that assessment, the IoT played a major role. This study consists of the measurement of various parameters relative to comfort conditions in a classroom, measurement of temperature, humidity, air quality and variations in lighting. Several connected measurement modules devices have been implemented in order to be able to carry out our study. Several scenarios are taken into account, such as the state of lighting, ventilation of the rooms. The outcome of this work will give us a tool allowing us to assess the comfort in different classroom.

COM.33 ***Low voltage low power bulk driven quasi floating gate digital to analog converter (DAC)***
Mounira BCHIR, Imen ALOUI, Nejib HASSEN

A novel high speed, low voltage (LV) low power (LP) current mode digital to analog converter (DAC) using the conventional technique (GD) an unconventional technique bulk driven quasi floating gate technique (BDQFG) is presented in this paper. The performance of the proposed DAC has been simulated using the GD and the BDQFG technique. The DAC

based in the BD-QFG showed high performance in terms of dynamic performances, supply voltage, and power consumption in comparison to the GD DAC. The conventional and unconventional 4 bits DAC has been simulated in 0.18 µm CMOS technology. The proposed circuit has been simulated through an ELDO simulator. The BD-QFG DAC achieves a bandwidth (750 MHz), low power consumption (0.114 mW), low supply voltage (0.8V).

Technical Session 8: Observer

CS.27 ***A discrete second order sliding mode observer using LMI approach***
Khouloud Elghoul, Khadija Dehdi, Ridha Ben Abdennour

The major drawback of first sliding mode techniques is the chattering phenomenon given by the discontinuous term especially for the discrete time systems. In this paper and with a view to reduce this phenomenon, new second order sliding mode observer (2-SMO) is proposed. The synthesis of this observer is based on the linear matrix inequalities approach (LMIs). Simulation results verify the theoretic analysis and demonstrate the effectiveness of the proposed observer mainly in precision, speed convergence and reducing of the chattering phenomenon. A comparison study with the classical SMO observer confirmed the notable enhancement of performances.

CS.32 ***A discrete interval observer for linear system: Application on a real process***
Tahri Fida, Messaoud Anis, Ben Abdennour Ridha

A discrete interval observers used for linear systems attacked by ignorant quantities that previously known only by its bounds, is the main goal for this paper. The most important condition that we are searching for always ensured is the cooperativity. To claim that, two methods are considered as a framework. The presented techniques values are illustrated in an example of simulation and by an application on a transesterification reactor. The obtained results show that it is feasible to have a cooperative dynamic for the observation errors either with a state transformation or by imposing a constraint.

CS.82 ***Observer-based controller for systems with time specifications***
Amani Added, Maher Ben Hariz, Faouzi Bouani

In this paper, an observer-based state feedback controller system is designed. A new method based on the Generalized Characteristic Ratio Assignment GCRA is used to set the polynomials of the LQR to reach the desired time specifications such as settling time and overshoot. The GCRA allows to define the weighting matrices Q and R. Then based on the separation principle and the GCRA method a full-order observer is derived and associated with the LQR controller to achieve the robust closed-loop performances. Simulation results are presented.