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CCE

# 2024 21st International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE)

# CCE 2024

## Mexico City. Mexico

## October 23-25, 2024

**HYBRID CONFERENCE**


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ELECTRON DEVICES SOCIETY

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# Keynote Speakers

**Plenary**

## Carlos Ocampo-Martinez, PhD

**Professor in Universitat Politècnica de Catalunya, Automatic Control Department (ESAII)**
**Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB)**
**Barcelona, España**
***https://carlos-ocampo.staff.upc.edu***

***Talk Title: "Event-Driven Partitioning for Non-Centralized Predictive Control in Economic Dispatch of Interconnected Microgrids"***
Wednesday October 23rd, 2024 – 9:20-10:20, Mexico City Time Zone (GMT-6, Central Time)
ROOM 4
Session Chair: Francisco Beltrán-Carbajal

**Plenary**

## Spyretta Golemati, PhD

**Professor in National and Kapodistrian University of Athens**
**Greece**
**https://www.embs.org/membership/chapters/distinguished-lecturers-program/distinguished-lecturers/spyretta-golemati/**
**CV**

***Talk Title: "Exploring cardiovascular mechanics with ultrasound"***
Wednesday October 23rd, 2024 – 10:30-11:30 - Mexico City Time Zone (GMT-6, Central Time)
ROOM 4
Session Chair: IEEE EMBS Student Chapter

**Plenary**

## Jorge I. Poveda, PhD

**Professor in Electrical and Computer Engineering department at the University of California, San Diego, United States.**

***Talk Title: "Prescribed-Time Stability in Switched Systems with Resets: A Hybrid Dynamical Systems Approach"***
Thursday October 24th, 2024- 10:00-11:00, Mexico City Time Zone (GMT-6, Central Time)
ROOM 4
Session Chair: Dr. Francisco Beltrán-Carbajal

## Plenary

### Kevin McComber, PhD

**CEO, Spark Photonics | Executive director, Spark Photonics Foundation United States.**

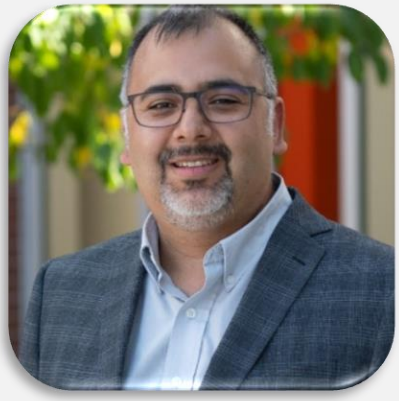
***Talk Title: "Empowering Semiconductor Innovation: Cultivating Technology and Education through Photonics"***

Thursday October 24th, 2024- 11:30-12:30, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

## Plenary



### David Estrada, PhD

**Professor of Materials Science and Engineering at Boise State University and Co-Founder of INFlex Labs, Boise Idaho, United States**

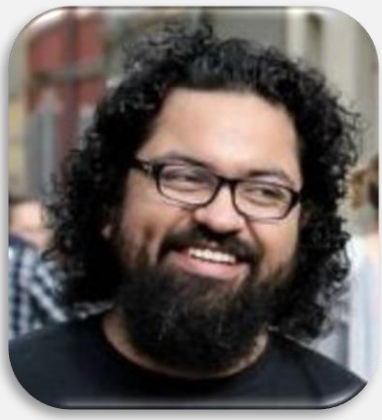
***Talk Title: "Building the future of printed electronics based on 1D and 2D semiconductors"***

Friday October 25th, 2024- 10:00-11:00, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

## Invited Lecture



### Anibal Pacheco, PhD

**Senior postdoctoral research in the Pervasive Electronics Advanced Research Laboratory, Universidad de Granada, Spain.**

***Talk Title: "Radiofrequency Circuits with Nano-Structured Material-Based Devices and Their Compact Modeling"***

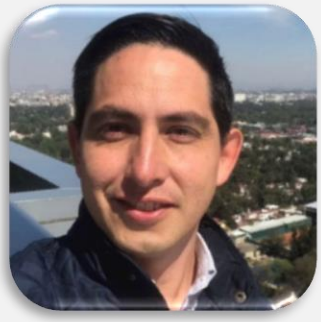
Friday October 25th, 2024- 11:30-12:30, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

# R & D Conferences

## Wednesday October 23rd, 2024



### Conference

**José de Jesús Rodríguez Flores**

**TEKTRONIX**

***Title: "Electrification: AC to DC transition"***

***Hour: 13:15-14:15, Mexico City Time Zone***

***ROOM 4***

*Session Chair: Jonathan Meza*

**José de Jesús Rodríguez Flores**

**TEKTRONIX**

***Title: "Fundamentals of Oscilloscopes and Analysis in Embedded Systems"***

***Hour: 15:30-16:30, Mexico City Time Zone***

***ROOM 4***

*Session Chair: Jonathan Meza*

## Thursday October 24th, 2024

### Workshop 1

**Jesús Rubén Santa Anna**

***RASPBERRY by GeekFactory***

***Title: "Building an IoT device with Raspberry Pi Pico W"***

***Hour: 13:00-15:00***

***ROOM 4***

*Session Chair: Jonathan Meza*

### Workshop 2

**Jesús Rubén Santa Anna**

***RASPBERRY by GeekFactory***

***Title: "Getting started for Raspberry Pi5 with the AI Kit"***

***Hour: 16:30-18:30***

***ROOM 4***

*Session Chair: Jonathan Meza*

# Schedule CCE 2024

**AC**: AUTOMATIC CONTROL, **BIO**: BIOMEDICAL ENGINEERING/ BIOMIMETICS, **COMM**: COMMUNICATIONS SYSTEMS, **CS**: COMPUTER SCIENCE AND COMPUTER ENGINEERING, **MEC**: MECHATRONICS, **NANO**: NANOTECHNOLOGY, **POW**: POWER ELECTRONICS, **SSM**: SOLID-STATE MATERIALS, ELECTRON DEVICES AND INTEGRATED CIRCUITS, **AE**: AERONAUTICS AND AEROSPACE ENGINEERING/ AUTONOMOUS NAVIGATION , **ME**: MECHANICAL ENGINEERING

| **Wednesday October 23rd, 2024**<br>**CINVESTAV** | | | | |
|---|---|---|---|---|
| ***Hour*** | ***Electrical Engineering Headquarters Building*** | | | |
| 8:30-9:00 | **Reception and coffee** | | | |
| ***Hour*** | ***Room 4-Auditorium*** | | | |
| 9:00-9:20 | **Opening Ceremony** | | | |
| 9:20-10:20 | **Plenary**<br>**Carlos Ocampo-Martinez, PhD**<br>**Professor in Universitat Politècnica de Catalunya**<br>**Automatic Control Department (ESAII)**<br>**Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB). Barcelona, España**<br>***"Event-Driven Partitioning for Non-Centralized Predictive Control in Economic Dispatch of Interconnected Microgrids"***<br>Session Chair : Dr. Francisco Beltrán-Carbajal | | | |
| 10:20-10:30 | **Break** | | | |
| 10:30-11:30 | **Plenary**<br>**Spyretta Golemati, PhD**<br>***Professor in National and Kapodistrian University of Athens, Greece.***<br>***"Exploring cardiovascular mechanics with ultrasound"***<br>Session Chair : IEEE EMBS Student Chapter | | | |
| 11:30-12:00 | **Break** | | | |
| ***Hour*** | ***Room 1*** | ***Room 2*** | ***Room 3*** | ***Room 4-Auditorium*** |
| 12:00-13:00 | **BIO1** | **SSM1** | **AC1** | **AE** |
| 13:00-13:15 | **Break** | | | |
| 13:15-14:15 | **BIO2** | **COMM1** | **MEC1** | **Conference R&D**<br>**TEKTRONIX**<br>***"Electrification: AC to DC transition"***<br>**José de Jesús Rodriguez Flores**<br>Session Chair: Jonathan Meza |
| 14:15-15:30 | **Break** | | | |
| 15:30-17:30 | **BIO3** | **CS1** | **AC2** | **Conference R&D**<br>**TEKTRONIX**<br>***"Fundamentals of Oscilloscopes and Analysis in Embedded Systems"***<br>**José de Jesús Rodriguez Flores**<br>**15:30-16:30**<br>Session Chair: Jonathan Meza |
| 17:45-18:45 | **Welcoming Reception** | | | |

**AC**: AUTOMATIC CONTROL, **BIO**: BIOMEDICAL ENGINEERING/ BIOMIMETICS, **COMM**: COMMUNICATIONS SYSTEMS, **CS**: COMPUTER SCIENCE AND COMPUTER ENGINEERING, **MEC**: MECHATRONICS, **NANO**: NANOTECHNOLOGY, **POW**: POWER ELECTRONICS, **SSM**: SOLID-STATE MATERIALS, ELECTRON DEVICES AND INTEGRATED CIRCUITS, **AE**: AERONAUTICS AND AEROSPACE ENGINEERING/ AUTONOMOUS NAVIGATION , **ME**: MECHANICAL ENGINEERING

| **Thursday October 24th, 2024**<br>**CINVESTAV** | | | | |
|---|---|---|---|---|
| ***Hour*** | ***Room 1*** | ***Room 2*** | ***Room 3*** | ***Room 4-Auditorium*** |
| 8:30-9:30 | **AC3** | **NANO1** | **MEC2** | **ME/POW** |
| 9:30-10:00 | **Break** | | | |
| ***Hour*** | ***Room 4-Auditorium*** | | | |
| 10:00-11:00 | **Plenary**<br>**Jorge I. Poveda, PhD**<br>**Professor in Electrical and Computer Engineering department at the University of California, San Diego, United States**<br>***"Prescribed-Time Stability in Switched Systems with Resets: A Hybrid Dynamical Systems Approach"***<br>Session Chair: Dr. Francisco Beltrán-Carbajal | | | |
| 11:00-11:30 | **Break** | | | |
| 11:30-12:30 | **Plenary**<br>**Kevin McComber, PhD**<br>**CEO, Spark Photonics \| Executive Director, Spark Photonics Foundation**<br>**linkedin.com/in/kevinmccomber**<br>***"Empowering Semiconductor Innovation: Cultivating Technology and Education through Photonics"***<br>Session Chair: Dra. Arely Cano-Martínez | | | |
| 12:30-13:00 | **Break** | | | |
| ***Hour*** | ***Room 1*** | ***Room 2*** | ***Room 3*** | ***Room 4-Auditorium*** |
| 13:00-15:00 | **AC4** | **SSM2** | **CS2** | **Workshop 1**<br>**RASPBERRY by GeekFactory**<br>**Jesús Rubén Santa Anna**<br>***"Building an IoT device with Raspberry Pi Pico W"***<br>Session Chair: Ing. Jonathan Meza<br>**Necessary kit for practice, which will be on sale the day before** |
| 15:00-16:30 | **Break** | | | |
| 16:30-18:30 | **BIO4** | **NANO2** | **CS3** | **Workshop 2:**<br>**RASPBERRY by GeekFactory**<br>***Jesús Rubén Santa Anna***<br>***"Getting started for Raspberry Pi5 with the AI Kit"***<br>Session Chair: Jonathan Meza<br>**Necessary kit for practice, which will be on sale the day before** |

**AC**: AUTOMATIC CONTROL, **BIO**: BIOMEDICAL ENGINEERING/ BIOMIMETICS, **COMM**: COMMUNICATIONS SYSTEMS, **CS**: COMPUTER SCIENCE AND COMPUTER ENGINEERING, **MEC**: MECHATRONICS, **NANO**: NANOTECHNOLOGY, **POW**: POWER ELECTRONICS, **SSM**: SOLID-STATE MATERIALS, ELECTRON DEVICES AND INTEGRATED CIRCUITS, **AE**: AERONAUTICS AND AEROSPACE ENGINEERING/ AUTONOMOUS NAVIGATION , **ME**: MECHANICAL ENGINEERING

| Friday October 25th, 2024<br>CINVESTAV | | | | |
|---|---|---|---|---|
| ***Hour*** | ***Room 1*** | ***Room 2*** | ***Room 3*** | ***Room 4-Auditorium*** |
| 8:30-9:50 | **BIO5** | **CS4** | **NANO3** | **SSM3** |
| 9:50-10:00 | **Break** | | | |
| ***Hour*** | ***Room 4-Auditorium*** | | | |
| 10:00-11:00 | **Plenary**<br>**David Estrada, PhD**<br>**Professor of Materials Science and Engineering at Boise State University and Co-Founder of INFlex Labs, Boise Idaho, United States**<br>***"Building the future of printed electronics based on 1D and 2D semiconductors"***<br>Session Chair : Arely Cano-Martínez | | | |
| 11:00-11:30 | **Break** | | | |
| 11:30-12:30 | **Invited Lecture**<br>**Anibal Pacheco, PhD**<br>**Senior postdoctoral research in the Pervasive Electronics Advanced Research Laboratory, Universidad de Granada, Spain.**<br>***"Radiofrequency Circuits with Nano-Structured Material-Based Devices and Their Compact Modeling"***<br>Session Chair : Arely Cano-Martínez | | | |
| 12:30-12:40 | **Break** | | | |
| ***Hour*** | ***Room 1*** | ***Room 2*** | ***Room 3*** | ***Room 4-Auditorium*** |
| 12:40-14:40 | **BIO6** | **CS5** | | **SSM4** |
| 14:50-15:10 | | | | **Closing ceremony** |

## From October 23 to 25, exhibition of products from the following companies:

Newark AN AVNET COMPANY

Raspberry Pi Foundation

OMEGA

Tektronix

Weller

**NATIONAL INSTRUMENTS**

# TECHNICAL PROGRAM

## Aeronautics and Aerospace Engineering -Autonomous Navigation (AE)

| ID | Hour | Session AE - Aeronautics and Aerospace Engineering<br>Wednesday October 23rd, 2024<br>12:00-13:00<br>Room 4<br>Session Chair: Dr. Oscar Alejandro García Pérez |
|---|---|---|
| ID 100 | 12:00-12:20 | Amandine Azzarello, Antoine Eon, José Gabriel Ramírez Torres and Jean-Pierre Gazeau.<br>**Mobile Manipulation Based on ROS1/ROS2 Middleware: Software Architecture and Evaluation of ROS2 Planning Algorithms** |
| ID 27 | 12:20-12:40 | Carlos Osorio Quero and Jose Martinez-Carranza.<br>**Physics-Informed Machine Learning for UAV Control** |
| ID 28 | 12:40-13:00 | Murat Bakirci and Irem Bayraktar.<br>**Assessment of YOLOv10 for Ship Detection in SAR Imagery under Open Ocean and Coastal Challenges** |

## Automatic Control (AC)

| ID | Hour | Session AC 1 - Automatic Control<br>Wednesday October 23rd, 2024<br>12:00-13:00<br>Room 3<br>Session Chair: Dra. Belém Saldívar Marquez |
|---|---|---|
| ID 2 | 12:00-12:20 | Antonio Saldivar-Mendez, Josue Gomez-Casas and America Berenice Morales-Diaz.<br>**Data-driven kinematic control with adaptive gains for a redundant robot** |
| ID 5 | 12:20-12:40 | Rodolfo Villalobos-Salazar, Abimael Contreras-Carlos, Carlos A. Toro-Arcila and America Morales-Diaz.<br>**Hierarchical Drone Navigation Control for Ensuring Safety with Stationary Humans** |
| ID 16 | 12:40-13:00 | Cesar Solis, Sergio Isai Palomino and Hipolito Aguilar.<br>**Self-Tuning PID Controller for Serial Robots with Real-Time Functional Optimization** |

| ID | Hour | Session AC 2 - Automatic Control<br>Wednesday October 23rd, 2024<br>15:30-17:30<br>Room 3<br>Session Chair: Lorenz Josue Oliva-Gonzalez |
|---|---|---|
| ID 38 | 15:30-15:50 | Lorenz Josue Oliva-Gonzalez and Rafael Martínez-Guerra.<br>**Fractional-Order Newton-Like State Estimator for Discrete-Time Nonlinear Systems** |

| | | |
|---|---|---|
| **ID 50** | 15:50-16:10 | Federico Augusto Trampe-Torija, Francisco Beltrán-Carbajal, Jorge Ramírez-Muñoz and Mario Sampedro Cruz.<br>**Non-linear Model based Trajectory Tracking Control for Drying Process of Spirulina platensis and Red Chili in a Type-Tunnel Dryer** |
| **ID 56** | 16:10-16:30 | Víctor Reza, Jorge Torres and Jesus Guerrero.<br>**A Continuous-Discrete ADRC for LTI Systems under Nonuniform Discrete Measurements and External Disturbances** |
| **ID 102** | 16:30-16:50 | Diego Hernán Gaytán Rivas, Jorge Rivera Domínguez, Susana Ortega Cisneros, Héctor Emmanuel Muñoz Zapata and Emilio Isaac Baungarten Leon.<br>**On the Novel Design and FPGA Implementation of a Fuzzy PD Control for a DC Motor** |
| **ID 105** | 16:50-17:10 | Emmanuel Gamero Ramirez, Jorge Antonio Torres Muñoz and Jesús Norberto Guerrero Tavares.<br>**Adaptive Gains Sliding Mode Observer for the Estimation of Unknown Dynamics in a Heavy Metal Bioremediation Process** |
| **ID 112** | 17:10-17:30 | Oscar Federico Garcia-Castro, Luis Enrique Ramos-Velasco, Vicente Parra-Vega, Rodolfo Garcia-Rodriguez and Carlos Ernesto Vazquez-Garcia.<br>**Neural Network Modeling of Continuum soft robots based on WaveNets Equipped with Adaptive IIR** |

**ID** **Hour**

## Session AC 3 - Automatic Control

**Thursday October 24th, 2024**
**8:30-9:30**
**Room 1**
**Session Chair: Dra. Sabine Marie Sylvie Mondie Cuzange**

| | | |
|---|---|---|
| **ID 119** | 8:30-8:50 | Pablo De Villeros, Juan Diego Sánchez-Torres, Michael Defoort and Alexander Loukianov.<br>**Fully Distributed Federated Learning Using a Zero-Gradient-Sum Algorithm** |
| **ID 132** | 8:50-9:10 | Oscar Gonzalez Miranda and Juan Manuel Ibarra Zannatha.<br>**Servomotor parameter identification using a Kalman filter with model reference estimator** |
| **ID 133** | 9:10-9:30 | Bruno Gutiérrez Chávez, Jonathan Muñoz Solis, Miguel Ramírez-Barrios, Manuel Mera Hernández, Rodrigo Mora Martínez and Bernardo Flores Ramírez.<br>**Preliminary experiments with a PI controller for cutting tissue with an electrosurgery unit** |

**ID** **Hour**

## Session AC 4 - Automatic Control

**Thursday October 24th, 2024**
**13:00-15:00**
**Room 1**
**Session Chair: Dr. Rubén Garrido Moctezuma**

| | | |
|---|---|---|
| **ID 135** | 13:00-13:20 | **ID135**<br>Claudia Rigel Duran, Filiberto Muñoz, Eduardo S. Espinoza and Benjamín N. Trinidad.<br>**Real-Time Tracking Control Using Adaptive Dynamic Programming for Underwater Vehicles** |
| **ID 139** | 13:20-13:40 | Carlos Aguilar-Ibanez, Miguel Suarez-Castanon, Belem Saldivar, Julio Mendoza-Mendoza and Manuel Jimenez-Lizarraga.<br>**A Robust trajectory tracking problem solution for a PVTOL system under crosswind** |

| | | |
|---|---|---|
| **ID 148** | 13:40-14:00 | Camila Sofía Sánchez García, Jorge Said Cervantes-Rojas and Eduardo Steed Espinoza Quesada.<br>**Fuzzy-Based Disturbance Rejection Control via Integral Sliding Mode for a Quadrotor Aerial Vehicle** |

# Biomedical Engineering/ Biomimetics (BIO)

| ID | Hour | |
|---|---|---|
| | | **Session BIO 1- Biomedical Engineering/ Biomimetics Measurement Systems**<br>**Wednesday October 23rd, 2024**<br>**12:00-13:00**<br>**Room 1**<br>**Session Chair: Dr. Arturo Vera Hernández** |
| **ID 137** | 12:00-12:20 | Jesús Fausto Córdova-Manzo, Gabriel Vega-Martínez, Cinthya Lourdes Toledo-Peral, Arturo Vera-Hernández, Lorenzo Leija-Salas and Gabriela Flores-Mondragón.<br>**Hydration Status During the Micturition Cycle Using Bioimpedance for Bladder Monitoring: A Pilot Study** |
| **ID 149** | 12:20-12:40 | Jesús Fausto Córdova-Manzo, Gabriel Vega-Martínez, Arturo Vera-Hernández, Lorenzo Leija-Salas and Josefina Gutiérrez-Martínez.<br>**Finite Element Model for Parameterization of Adipose Tissue Thickness to Assess Near-Infrared Infrared Beam Penetration: A First Approach** |
| **ID 142** | 12:40-13:00 | Ramon Eduardo Cortina, Janette Arminda Magaña Cortes, Abraham Hernández Jiménez, Fernando Perez Escamiroza, Daniel Lorias Espinoza and Arturo Minor Martinez.<br>**Artificial Vision System for Physical Activity Practice for People with Visual Impairment** |
| | **Hour** | **Session BIO 2 - Biomedical Engineering/ Biomimetics - Prototype Proposals**<br>**Wednesday October 23rd, 2024**<br>**13:15-14:15**<br>**Room 1**<br>**Session Chair: Dra. Blanca Tovar Corona** |
| **ID 124** | 13:15-13:35 | Uriel Pérez Flores, Amparo Dora Palomino Merino, Jesús Ricardo López Gutiérrez and Sergio Vergara Limon.<br>**Modeling and Control of Ankle Exoskeleton** |
| **ID 165** | 13:35-13:55 | María Lesvia Escobar-Hernández, Jesús Fausto Córdova-Manzo, Daniel Acosta-Mares, Arturo Vera-Hernández, Lorenzo Leija-Salas, Josefina Gutiérrez-Martínez and Jesús Fausto Córdova-Escobedo.<br>**Urological Condition Simulator for Accurate Uroflowmeter Calibration and Testing** |
| **ID 29** | 13:55-14:15 | Adriana Martínez-García, Irving Ríos-Valtierra, Victor Hernández-Valderrama, Jóse Gutiérrez-Gnecchi and Daniel Lorias-Espinoza.<br>**Prototype of USB Flexible Endoscope for Training Based on theTask of the Society of American Gastrointestinal and Endoscopy Surgeons Tasks: Simulation and design.** |

| ID | Hour | |
|---|---|---|
| | | **Session BIO 3 - Biomedical Engineering/ Biomimetics Sensors And Systems**<br>**Wednesday October 23rd, 2024**<br>**15:30-17:30**<br>**Room 1**<br>**Session Chair: Dra. Blanca Tovar Corona** |
| **ID 37** | 15:30-15:50 | Nafisa Zarrin Tasnim, Aoxin Ni, Edward Lobarinas and Nasser Kehtarnavaz.<br>**Personalization and Smartphone Implementation of ADRO Hearing Aid Amplification by Bayesian Machine Learning** |
| **ID 76** | 15:50-16:10 | Oscar Eduardo Aguilar Mejía, Ernesto Suaste Gómez and José de Jesús Agustín Flores Cuautle.<br>**Development of novel lead-free ceramic electrodes for the acquisition of bioelectric potentials.** |
| **ID 147** | 16:10-16:30 | Víctor García Limón, Ernesto Suaste Gómez and Alfredo Cruz Orea.<br>**Ferromagnetic membrane pore opening control and laser pattern analysis** |
| **ID 60** | 16:30-16:50 | Juan de Dios Ortiz Alvarado, Juan Carlos Rodríguez Sierra and Mario Josué Aguilar Méndez.<br>**Operating Conditions for Performance Improvement of Paired Emitter Detector Diode in Optical Measurements Based on Photocapacitance Discharge** |
| **ID 104** | 16:50-17:10 | Ada Michelle Velazquez Flores, José Abraham Morales Jimenez, Cristina Elizabeth Reyes Soto, Rigoberto Martinez Mendez, Zeus Tlaltecutli Dominguez Vega and Otniel Portillo Rodríguez.<br>**Effect of Foot Position on Postural Balance Assessment Using Center of Pressure Parameters During the Romberg Test** |
| **ID 93** | 17:10-17:30 | Shoma Khanom, Mohammad Sakib, Nm Chisty, Munira Akter Mimi, Md. Ahad and Feroz Ahmed.<br>**Detection of Leg Tremors in Parkinson's Disease Patients: An Experimental Wearable Leg Band Solution** |
| **ID** | **Hour** | |
| | | **Session BIO 4 - Biomedical Engineering/ Biomimetics - Signal Processing and Classification**<br>**Thursday October 24th, 2024**<br>**16:30-18:30**<br>**Room 1**<br>**Session Chair: Dr. Carlos Alvarado Serrano** |
| **ID 159** | 16:30-16:50 | Josefina Gutierrez-Martinez, Jorge Airy Mercado-Gutierrez, Luis Eduardo Pachecho González, Jimena Quinzaños-Fresnedo, Ana G. Ramirez-Nava, Guadalupe Benitez-Sanchez and Oscar Yanez-Suarez.<br>**Network Connectivity Measures to Assess Changes in Brain Activity of Stroke Patients** |
| **ID 69** | 16:50-17:10 | José Desiderio Torres Rodríguez, Blanca Tovar Corona and Álvaro Anzueto Rios.<br>**Normal and Abnormal Lung Sound Classification for An Embedded System Implementation** |
| **ID 46** | 17:10-17:30 | José Castro-Gómez, Omar Hernandez, Boubekeur Targui, Guillermo Valencia-Palomo and Maria-Eusebia Guerrero-Sánchez.<br>**Glucose Estimation In A Diabetes Mellitus Virtual Patient With Sampled Signal And Input Delay** |
| **ID 71** | 17:30-17:50 | José-Emmanuel Vázquez-Galán, Laura-Ivoone Garay-Jiménez, Blanca Tovar-Corona and Martín-Arturo Silva-Ramírez.<br>**Synthetic EEG Signal Generator of Morphologies Associated with Epileptogenic Events** |

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|---|---|---|
| **ID 155** | 17:50-18:10 | Luis E. Cruz-Carrasco, Marcos A. Perez-Espinoza, Dulce Martinez-Peon, Vicente Parra-Vega, Nadia Garcia-Hernandez and Xochitl A. Ortiz-Jimenez.<br>**Towards an Online Brain Computer Interface based on Binary Kinesthetic Motor Imagery Paradigm** |
| **ID 65** | 18:10-18:30 | Yoltic Uriel Palomino Ortega, Marco Antonio Hernández Alanis, Gabriel Sepúlveda Cervantes, Adrián Octavio Ramírez Morales and Blanca Tovar Corona.<br>**Neurofeedback training system to induce concentration states using virtual reality** |

**ID** **Hour**

## Session BIO 5 - Biomedical Engineering/ Biomimetics - Image Processing and Classification

**Friday October 25th, 2024**
**8:30-9:50**
**Room 1**
**Session Chair: Dra. Blanca Tovar Corona**

| | | |
|---|---|---|
| **ID 157** | 8:30-8:50 | Mohammad Sakib, Md. Asadullah, Sharif Mohd Shams, Md. Delowar Hossain, Md. Monzu Uddin and M. Mofazzal Hossain.<br>**Eczema and Seborrheic Keratoses: A Novel Method for Skin Disease Classification Using Image-Based Analysis** |
| **ID 23** | 8:50-9:10 | Tarek Berghout.<br>**Iron Deficiency Anemia Diagnosis for Young Children: Image-Driven Comparative Analysis of Recurrent and Projected Neural Networks** |
| **ID 90** | 9:10-9:30 | Tarek Berghout.<br>**Anemia Severity Detection in Pediatric Patients through REXlayer-Integrated Deep Learning and Eye Conjunctival Imaging** |

**ID** **Hour**

## Session BIO 6 - Biomedical Engineering/ Biomimetics - Image Processing and Classification

**Friday October 25th, 2024**
**12:40-14:40**
**Room 1**
**Session Chair: Dr. Rafael Bayareh Mancilla**

| | | |
|---|---|---|
| **ID 52** | 12:40-13:00 | Nirvana Cinnereth Amparan-Ortega, Juan Alberto Ramirez-Quintana, Mario Ignacio Chacon Murguia and Alma Delia Corral-Saenz.<br>**Deep Neural Network Evaluation for Emotion Recognition through Facial Expressions Analysis** |
| **ID 106** | 13:00-13:20 | Mayra Adriana León-Sánchez, Yazmín Mariela Hernández-Rodríguez, Oscar Eduardo Cigarroa-Mayorga and Rafael Bayareh-Mancilla.<br>**Comparative Analysis of CLAHE and VOI LUT for Enhanced Mammogram Contrast in Tumor Detection** |
| **ID 55** | 13:20-13:40 | Donaldo Francisco Vega Lagunas, Arturo Vargas-Olivares, J. Enrique Chong-Quero, Héctor Cervantes-Culebro, Carlos A. Cruz-Villar, Laura Curiel and Samuel Pichardo.<br>**Evaluation of Segmentation Quality in Magnetic Resonance Images using Singular Value Decomposition: A Feasibility Study** |
| **ID 126** | 13:40-14:00 | Héctor Gerardo Martínez Fuentes, Mario Ibrahin Gutierrez, Jorge Airy Mercado Gutierrez and Josefina Gutiérrez Martínez.<br>**Exploring Reproducibility of fMRI Analysis Using SPM and Nilearn Open-Source Tool** |
| **ID 21** | 14:00-14:20 | Benjamin Eduardo Aguilar Arce, Ingrid Gutiérrez Villegas and Gerardo Vera Juárez.<br>**Implementation of Computer Vision and Image Processing in Technovigilance at the National Institute of Cardiology Ignacio Chávez: Adenosine Vial Case** |

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|---|---|---|
| **ID 36** | 14:20-14:40 | Alfredo Bayu Satriya, Myles Joshua Tan and Yong-Kyu Yoon.<br>**Machine Learning-Based Thickness Estimation of Abdominal Fat and Muscle Using Simulated Radio Frequency Scattering Parameters** |

## Communications systems (COMM)

**ID** **Hour**

### Session COMM 1 - Communications systems

**Wednesday October 23rd, 2024**
**13:15-14:15**
**Room 2**
**Session Chair: Dr. Mauricio Lara Barrón**

| | | |
|---|---|---|
| **ID 39** | 13:15-13:35: | Aleksey Gvozdarev and Tatiana Artemova.<br>**Performance Analysis of an Amplify-and-Forward Relay-Assisted Communication in the Presence of Double-Rayleigh Fading and Shadowing** |
| **ID 57** | 13:35-13:55 | Fernando Evier Lopez Perez and Jose Cruz Nunez Perez.<br>**FPGA Emulation of the Physical Layer of an 802.11n-Based Transceiver** |
| **ID 72** | 13:55-14:15 | Ramon Ulises Almada Prieto, Gilberto Enrico Vazquez Alcaraz and Jose Cruz Nunez Perez.<br>**Graphical Interface for Obtaining Lyapunov Exponents in Fractional Order Chaotic Systems** |

## Computer Science and Computer Engineering (CS)

**ID** **Hour**

### Session CS 1 - Computer Science and Computer Engineering – Health Care Applications

**Wednesday October 23rd, 2024**
**15:30-17:30**
**Room 2**
**Session Chair: Dr. Ernesto López Mellado**

| | | |
|---|---|---|
| **ID 18** | 15:30-15:50 | Tarek Berghout.<br>**Improved Anemia Medical Diagnosis on Complete Blood Count: Tuning Projected Long-Short Term Memory Layers with Coefficient of Determination** |
| **ID 84** | 15:50-16:10 | Abqa Javed, Sahar Ajmal, Taliah Tajammal, Muhammad Aslam, Ana Maria Martinez-Enriquez and Usman Sadiq Sheikh.<br>**Enhancing Anxiety Prediction: Leveraging Machine Learning with Functional Design Metrics** |
| **ID 130** | 16:10-16:30 | Nazhir Amaya-Tejera, Eduardo Zurek and Matías Alvarado.<br>**Emotion Regulation in Breast Cancer Patients: Initial study with Regression Models** |
| **ID 156** | 16:30-16:50 | Carlos Minutti.<br>**Unraveling the Complex Interplay Between Socioeconomic Status, Air Pollution, and Heart Disease Hospitalizations in an Urban Population** |
| **ID 44** | 16:50-17:10 | Aoxin Ni, Edward Lobarinas and Nasser Kehtarnavaz.<br>**Field Deployment of Personalized DSLv5 Hearing Aid Amplification by Bayesian Machine Learning** |
| **ID 20** | 17:10-17:30 | Lamia Alam and Nasser Kehtarnavaz.<br>**Improving Identification of Defective Wafer Maps by Data Augmentation via Enhanced CycleGAN** |

| ID | Hour | |
|---|---|---|
| | | **Session CS 2 - Computer Science and Computer Engineering – Systems analysis**<br>**Thursday October 24th, 2024**<br>**13:00-15:00**<br>**Room 3**<br>**Session Chair: Dra. Ana María Martínez Enríquez** |
| **ID 10** | 13:00-13:20 | Erick Axel Martinez Ríos and Rogelio Bustamante-Bello.<br>**Parameter Selection of Generalized Morse Wavelets for Water Leakage Classification** |
| **ID 47** | 13:20-13:40 | Carlos Adolfo Cardenas Flores, Marco Antonio Silva Maldonado, Jesus Emiliano Chavez Garcia, Jesus Adan Ibarra Castro, Reyes Apolonio Castro Corral and Marcos Eduardo Cruz Victorio.<br>**Development of wind speed forecast models using Artificial Intelligence in Mexicali** |
| **ID 96** | 13:40-14:00 | Mohammad Sakib, Hanif Mia, Mukta Akter, Jannatul Farduse, Sharmin Akter and Md. Shahjalal.<br>**Rainfall Prediction and Real-Time Weather Monitoring in Bangladesh: A Comparative Analysis of Machine Learning Algorithms** |
| **ID 97** | 14:00-14:20 | Mohammad Sakib, Sadikul Hasan Mridha Atul, Tania Sarkar, Hanif Mia, A.S.M. Daiyan Haider Nafiu and Md. Shahjalal.<br>**Monitoring Toxic Gases in Dhaka Brick Kiln Areas & Comparing CNN vs. ResNeT for Brick Kiln Identification via Satellite Imagery in Bangladesh** |
| **ID 154** | 14:20-14:40 | Giovanni Caicedo, Diana Peralta Garcia, Jaime Andres Perez Taborda and Liliana Vera Londoño.<br>**Low-Cost Portable Device for Water Quality Monitoring** |
| **ID 164** | 14:40-15:00 | Cristian Ayala, Manuela Londoño, Samuel Lopez, Vanesa Triana, Daniela Payares and Juan Sebastian Sanchez-Gomez.<br>**Transportation models and unsupervised learning methods to minimize food waste in schools of Medellin** |
| **ID** | **Hour** | |
| | | **Session CS 3 - Computer Science and Computer Engineering – Object detection and process discovery**<br>**Thursday October 24th, 2024**<br>**16:30-18:30**<br>**Room 3**<br>**Session Chair: Dr. Antonio Ramírez Treviño** |
| **ID 35** | 16:30-16:50 | Murat Bakirci and Irem Bayraktar.<br>**Comparative Performance of YOLOv9 and YOLOv10 for Vehicle Detection towards Real-Time Traffic Surveillance with UAVs** |
| **ID 114** | 16:50-17:10 | Maria Laura Miranda Leon, Jesús Carlos Pedraza Ortega, Marco Antonio Aceves Fernandez and Juan Manuel Ramos Arreguin.<br>**A Comparative Analysis of Object Detection Models for Drowsiness Detection: Evaluating Raw, Processed, and Hybrid Image Datasets with Faster R-CNN** |
| **ID 120** | 17:10-17:30 | Zareen Tasnim Pear and Hafsa Binte Kibria.<br>**Enhanced Network Intrusion Detection Using a Hybrid CNN-LSTM Approach on the UNSW-NB15 Dataset** |
| **ID 161** | 17:30-17:50 | Zhengmao Ye.<br>**Computational Complexity Reduction in Feature Detection via Nonlinear Component Analysis and Information Quantitative Synthesis** |
| **ID 141** | 17:50-18:10 | Ernesto Lopez-Mellado and Néstor Martínez-Medina.<br>**Synthesis of WFN from Reduced Event Logs based on Event Precedence Structures** |

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|---|---|---|
| **ID 33** | 18:10-18:30 | Marina Montes-Partida and Ernesto Lopez-Mellado.<br>**Accuracy Measures for Timed Petri Nets** |

| **ID** | **Hour** | **Session CS 4 - Computer Science and Computer Engineering – Image analysis**<br>**Friday October 25th, 2024**<br>**8:30-9:50**<br>**Room 2**<br>**Session Chair: Dr. Rogelio Hasimoto Beltrán** |
|---|---|---|
| **ID 42** | 8:30-8:50 | Areli Cabrera Oros, Jonathán de Jesús Estrella Ramírez and Juan Carlos Gómez Carranza.<br>**Late Fusion of Text and Images for Predicting User Interests in Pinterest Social Network** |
| **ID 73** | 8:50-9:10 | Emmanuel de Jesus Gonzalez-Ramos, Luis Angel Olvera-Martinez, Manuel Cedillo-Hernandez, Carlos Adolfo Diaz-Rodriguez and Leonardo Faustino-Morales.<br>**Symmetric cipher for grayscale images based on quantum differential geometry** |
| **ID 74** | 9:10-9:30 | Erasmo Gabriel Martínez Soltero, Joshua Alexander Aguilar, Carlos Humberto Avila Sanchez and Alma Y. Alanis.<br>**Semantic Segmentation to Identify Enemies in First-Person Shooters** |

| **ID** | **Hour** | **Session CS 5 - Computer Science and Computer Engineering – Architectures and Machine learning**<br>**Friday October 25th, 2024**<br>**12:40-14:40**<br>**Room 2**<br>**Session Chair: Dr. Rogelio Hasimoto Beltrán** |
|---|---|---|
| **ID 6** | 12:40-13:00 | Sara Yousefi and Seyedreza Taghizadeh.<br>**AnyComputing: A Novel Architecture for Orchestrating Various Computing Paradigms for Adaptive Workload Management** |
| **ID 136** | 13:00-13:20 | Adriana Perez-Navarro and Brisbane Ovilla-Martinez.<br>**Hardware Architecture for the SHA-3 Family in CRYSTALS-KYBER: Post-Quantum Cryptography** |
| **ID 45** | 13:20-13:40 | Víctor Rodríguez, Luis Pizano and Omar Longoria.<br>**Application of Machine Learning Techniques to Characterize AI Benchmarks using Hardware Events** |
| **ID 48** | 13:40-14:00 | Ali Alouache.<br>**Feature Selection using Teaching-Learning-Based Optimization Algorithm for Classification of Remote Sensing Images** |
| **ID 61** | 14:00-14:20 | Francisco-Javier Moreno-Vazquez, Felipe Trujillo-Romero and Amanda Enriqueta Violante Gavira.<br>**Enhanced Fuzzy Inference System for PM10 Concentration Prediction Using Genetic Algorithms** |
| **ID 68** | 14:20-14:40 | Gerardo Hernández, Alejandro Rodríguez, Máximo Sánchez and Mario Villafuerte.<br>**Forward-Forward Algorithm on Morphological-Linear Neural Networks** |

## Mechanical Engineering (ME) / Power Electronics (POW)

| ID | Hour | Session ME/POW – Mechanical Engineering (ME) / Power Electronics (POW)<br>Thursday October 24th, 2024<br>8:30-9:30<br>Room 4<br>Session Chair: Dr. Luis Gerardo Trujillo Franco/Dr. Oscar Alejandro Pérez |
|---|---|---|
| ID 145 | 8:30-8:50 | Hector S. Sanchez-Villegas, Luis G. Trujillo-Franco, Hugo F. Abundis-Fong and Gerardo Silva-Navarro.<br>**On the evaluation of low-cost piezoelectric sensors in modal testing: A case study** |
| ID 70 | 8:50-9:10 | Oswaldo Emiliano Rufino-Arteaga and Oscar Alejandro Garcia-Perez.<br>**Structural Health Monitoring in the Assembly of the Torsion Box and the Semi-wings** |
| ID 129 | 9:10-9:30 | Omar Sandre Hernandez, Jesus Patricio Ordaz Oliver, Roberto Morales and Enrique Hernández Rodríguez.<br>**A Cascade Constrained MPC scheme for the Speed and Current Control of an Induction Motor Drive** |

# Mechatronics (MEC)

| ID | Hour | Session MEC 1– Mechatronics<br>Wednesday October 23rd, 2024<br>13:15-14:15<br>Room 3<br>Session Chair: Dr. Juan Fernando Peza Solís |
|---|---|---|
| ID 101 | 13:15-13:35 | Mauro Alberto Lopez, Richard Torrealba, Cesar Augusto Arriaga and Edna Iliana Tamariz.<br>**IoT-Based USV for Water Quality Monitoring** |
| ID 150 | 13:35-13:55 | Carlos Ernesto Vazquez-Garcia, Jose Elias Perales-Mayorga, Vicente Parra-Vega and Nadia Vanessa Garcia-Hernandez.<br>**Navigation in a 3D Virtual Environment under Continuum Soft Robot Guidance: A Preliminary Study** |
| ID 158 | 13:55-14:15 | Hugo Yañez-Badillo, Daniel Galvan-Perez, Francisco Beltran-Carbajal and Ivan Rivas-Cambero.<br>**Integration of Virtual Vibration Absorbers in UAV Motion Control Design for Monitoring Civil Structures in Dam Engineering** |

| ID | Hour | Session MEC 2– Mechatronics<br>Thursday October 24th, 2024<br>8:30-9:30<br>Room 3<br>Session Chair: Dr. Juan Fernando Peza Solís |
|---|---|---|
| ID 64 | 8:30-8:50 | José Manuel Ramírez Puente, José Manuel Rivera Garnica and Cesar Augusto Garcia-Isáis.<br>**Measuring hardness system based on image processing** |
| ID 115 | 8:50-9:10 | Michelle Guerra Marín, María Aurora Diozcora Vargas Treviño, Sergio Vergara Limón, Jesús López Gómez, C. Leopoldo Carreon Diaz de Leon and Daniel Marcelo Gonzalez Arriaga.<br>**A Convolutional Neural Network-based Parametric Identification for the Dynamic Model of a Cartesian Robot in a FPGA Framework** |

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|---|---|---|
| **ID 116** | 9:10-9:30 | Juan Francisco Pintor Michimani, María Aurora Diozcora Vargas Treviño, Sergio Vergara Limon, Jesús López Gómez, Margarita Carmina García Gómez and Luis Arturo Alcantar Vergara.<br>**Design and Implementation of a Probe for 3D Scanning with FPGA-Based Architecture** |

# Nanotechnology (Materials and Applications) (NANO)

**ID** **Hour**

## Session NANO 1 - Nanomaterials and Applications

**Thursday October 24th, 2024**
**8:30-9:30**
**Room 2**
**Session Chair: Dra. Reyna Méndez Camacho**

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|---|---|---|
| **ID 30** | 8:30-8:50 | Jessé de Oliveira Damião, Marcelo Antonio Pavanello and Michelly de Souza.<br>**Electrical Characterization of nMOSFETs from a 180 nm Commercial Technology at Low Temperatures** |
| **ID 92** | 8:50-9:10 | Alfredo Morales Sánchez, José Juan Avilés Bravo, Braulio Palacios Márquez, Karim Monfil Leyva, Mario Moreno Moreno and Luis Hernandez Martínez.<br>**Effect of the Thermal Annealing Temperature on the Composition and Luminescent Properties of Silicon Rich-Nitride (SRN) and -Oxide (SRO) Films** |
| **ID 53** | 9:10-9:30 | Giovanni Almeida Matos, Jaime Calçade Rodrigues, Michelly de Souza, Mikael Cassé, Sylvain Barraud, Olivier Faynot and Marcelo A. Pavanello.<br>**Experimental Decomposition of the Carrier Mobility in the Conduction Planes of 2-Level Stacked Nanowires** |

**ID** **Hour**

## Session NANO 2 - Nanomaterials and Applications

**Thursday October 24th, 2024**
**16:30-18:30**
**Room 2**
**Session Chair: Dr. Salvador Gallardo Hernández**

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|---|---|---|
| **ID 75** | 16:30-16:50 | Citlalli Rodriguez, Cesar Camas, Dorian Valencia, Irving Zúñiga and Heber Vilchis.<br>**Multiscale Computational Roughness Analysis of InGaAs Growth Process for Solar Cell Applications** |
| **ID 49** | 16:50-17:10 | Asma Dekkiche, M. O. Bellouber, Hichem Ferhati, K. Dibi and Fayçal Djeffal.<br>**Novel Ultraviolet Phototransistor Design Based On SnO2 Thin-Film Combined With Surface Ag Nanoparticles** |
| **ID 66** | 17:10-17:30 | Francisco Javier Cano, Odin Reyes Vallejo, Ashok Adhikari, Sandrine Coste, Velumani Subramaniam, Abdelhadi Kassiba, Iouri Koudriavtsev and Jose Juan Diaz Lopez.<br>**Optical and electrical properties of TiO2-GO hybrid nanostructures by ball-milling** |
| **ID 125** | 17:30-17:50 | Kevin Rueda Castellanos, Brenda Garcia Farrera, Maria de La Luz Olvera Amador and Venkata Krishna Karthik Tangirala.<br>**CO Gas Sensing Properties of Zn2SnO4 Thinfilms.** |
| **ID 108** | 17:50-18:10 | Alfonso Caleb Vázquez Ruiz, Yael Magaña Aguilar, Fernando Almendra Cruz and Venkata Krishna Karthik Tangilara.<br>**Effect of Al doping on SnO2 nanoparticles for CO sensing** |
| **ID 31** | 18:10-18:30 | K. Kacha, Adel Bendjerad, Hichem Ferhati, Fayçal Djeffal and A Benhaya.<br>**Optical and Electrical characteristics of Flexible AZO-Cu-AZO Structure Prepared Via RF sputtering Technique** |

| ID | Hour | |
|---|---|---|
| | | **Session NANO3 - Nanomaterials and Applications**<br>**Friday October 25th, 2024**<br>**8:30-9:50**<br>**Room 3**<br>**Session Chair: Dra. Reyna Méndez Camacho** |
| **ID 51** | 8:30-8:50 | Francisco J. Cano, Odín Reyes Vallejo, Rocío Magdalena Sánchez Albores, Ashok A., Fernández Vázquez Vázquez, Salvador Escobar, Arturo Fernández Madrigal and Sebastian P.J..<br>**Adsorption of dyes by charcoal and activated charcoal from Moringa Oleifera leaves** |
| **ID 107** | 8:50-9:10 | Israel Iván Lara Garcilazo, Juan Jesús Rocha Cuervo, Venkata Krishna Karthik Tangirala and Angélica Guadalupe Hernández Zanabria.<br>**Green Synthesis of ZnO and $SnO_2$: structural and morphological studies based on citrus extracts** |
| **ID 15** | 9:10-9:30 | Israel Iván Lara Garcilazo, Venkata Krishna Karthik Tangirala and Arturo Maldonado Álvarez.<br>**Photocatalytic Degradation of Levonorgestrel by Sprayed ZnO Thin Films** |
| **ID 62** | 9:30-9:50 | Odin Reyes Vallejo, Rocío Magdalena Sánchez Albores, Roliber Escobar Velazquez, Clara López Aguilar, Francisco J Cano, Ashok A., José Escorcia García and Pascual Bartolo Pérez.<br>**Adsorption of Malachite Green on CaO-ZnFe2O4 Composite Derived from Agroindustrial Waste** |

# Solid-state materials, Electron Devices and Integrated Circuits (SSM)

| ID | Hour | |
|---|---|---|
| | | **Session SSM 1 - Solid-state materials, Electron Devices and Integrated Circuits –**<br>**Advanced FET Technologies**<br>**Wednesday October 23rd, 2024**<br>**12:00-13:00**<br>**Room 2**<br>**Session Chair: Dra. Arely Cano Martínez** |
| **ID 34** | 12:00-12:20 | R. Ouchen, I. Rahmani, H. Ferhati and F. Djeffal.<br>**Performance Assessment of Nanoscale SiGe High-k Negative Capacitance Junctionless GAA MOSFETs** |
| **ID 99** | 12:20-12:40 | Hichem Ferhati, Fayçal Djeffal and Tarek Berghout.<br>**Steep Subthreshold Swing Nanoscale Tunnel FET based on Silicon Tin Channel and High-k Dielectric Gate** |
| **ID 109** | 12:40-13:00 | Rabia Ouchen, Tarek Berghout, Fayçal Djeffal and Hichem Ferhati.<br>**Subthreshold Swing Performance Assessment of Nanoscale Junctionless GAA FETs using Machine Learning Approach** |

| ID | Hour | |
|---|---|---|
| | | **Session SSM 2 - Solid-state materials, Electron Devices and Integrated Circuits –**<br>**Light-Emitting Devices: Materials and Innovations/Memristors and Emergening Circuit**<br>**Thursday October 24th, 2024**<br>**13:00-15:00**<br>**Room 2**<br>**Session Chair: Dr. Yurik Kudriavtsev/ Dr. Angel Sacramento Orduño** |
| **ID 79** | 13:00-13:20 | Maricela Meneses, Mario Francisco Ávila Meza, Juan Ramon Ramos Serrano, Yasuhiro Matsumoto, Manmohan Jain and Srinivas Godavarthi.<br>**White electroluminescence of SiOxCy films obtained by HW-CVD using vinyl silane** |
| **ID 81** | 13:20-13:40 | Juan Ramón Ramos-Serrano, Mario Moreno, Alfredo Morales, Armando Hernández, Victor Aca and Ignacio Juárez.<br>**DC and RF Sputtered ITO Thin Films as Electrodes in Light-emitting Diodes Based on a-Si1-xCx:H** |
| **ID 59** | 13:40-14:00 | Juan Federico Ramirez Rios, Jose Juan Aviles Bravo, Sergio Alfonso Pérez García, Mario Moreno Moreno, Juan Ramón Ramos Serrano and Alfredo Morales Sánchez.<br>**Luminescent Defects in ZnO Thin Films: Effect of the Deposition Temperature and Thermal Treatment** |
| **ID 113** | 14:00-14:20 | Jesús Jiménez-León, Arturo Sarmiento-Reyes and Pedro Rosales-Quintero.<br>**Novel Modeling Methodology for Memristive Devices for Circuit Design and Simulation** |
| **ID 118** | 14:20-14:40 | Ashok Adhikari, Dwight Roberto Acosta-Najarro, Amira Jalil Fragoso-Medina, Tommy Kevin Merino Alama, Odin Reyes Vallejo, Francisco Javier Cano and María de La Luz Olvera Amador.<br>**An Application of Vanadium Oxide Thin Film as Window Layer in CIGSe Thin Film Solar Cells: A Computational Study** |
| **ID** | **Hour** | **Session SSM 3 - Solid-state materials, Electron Devices and Integrated Circuits –**<br>**Machine Learning meets Semiconductors Electronics**<br>**Friday October 25th, 2024**<br>**8:30-9:50**<br>**Room 4**<br>**Session Chair: Dr. Felipe Gomez Castañeda** |
| **ID 32** | 8:30-8:50 | Andrey Sarahy Santiago Rosales, Gerardo Marcos Tornez Xavier, Merlina Angélica Navarro Villanueva, Oliverio Arellano Cárdenas, Luis Martín Flores Nava and Felipe Gómez Castañeda.<br>**Digital Emulation System for Combined Cycle Plants based on Machine Learning** |
| **ID 80** | 8:50-9:10 | Luis Elias Salgado Solano, Oliverio Arellano Cárdenas, Luis Martin Flores Nava and Felipe Gómez Castañeda.<br>**Bearing Failure Classification with Metaheuristic Adjust of the Extreme Learning Machine Model** |
| **ID 43** | 9:10-9:30 | Daniel Apolinar Amaro Caraveo, Arturo Velasco Hernández, Claudia Elena Pérez García, José Santos Cruz, Francisco Javier de Moure Flores and Sandra Andrea Mayén Hernández.<br>**Novel Synthesis of Bi2MoO6 Thin Films for Sunlight-driven Photocatalysis** |

| ID | Hour | Session SSM 4 - Solid-state materials, Electron Devices and Integrated Circuits<br>Next-Generation Thin Films for Trasparent Electronics<br>Friday October 25th, 2024<br>12:40-14:40<br>Room 4<br>Session Chair: Dr. David Mateus Torres Herrera/Gabriel Romero Paredes |
|---|---|---|
| ID 19 | 12:40-13:00 | Rosa Nava-Sanchez, Gaspar Casados-Cruz and Arturo Morales-Acevedo.<br>**High conductivity copper iodide (γ-CuI) thin films deposited by a spin-coating technique** |
| ID 25 | 13:00-13:20 | Kacha Kalinka, Hichem Ferhati, Adel Bendjerad, Fayçal Djeffal and A Benhaya.<br>**Effects of Ni/Cu Bilayer Structure On The Optical and Electrical Characteristics of Al-doped ZnO Thin-Film** |
| ID 82 | 13:20-13:40 | Gabriela Barron, Maria de La Luz Olvera, Arturo Maldonado and Heberto Gomez Pozos.<br>**Structural, electrical and optical properties of ZnO films deposited by ultrasonic chemical spraying for application as transparent conductors** |
| ID 127 | 13:40-14:00 | Luz Margarita Balcazar Villatoro, Arturo Maldonado Alvarez and Maria De La Luz Olvera Amador.<br>**Transparent and conductive Al-doped ZnO thin films. Influence of Al concentration** |
| ID 134 | 14:00-14:20 | Eduardo Benito Ramirez, Arturo Maldonado and Maria de La Luz Olvera.<br>**Effect of Doping ZnO Films with Cu on the Decoloration of Methylene Blue by Photocatalysis** |

# ABSTRACTS

## Plenary and Invited Lecture

### Plenary


**Carlos Ocampo-Martinez, PhD**

**Professor in Universitat Politècnica de Catalunya, Automatic Control Department (ESAII)**
**Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB)**
**Barcelona, España**
*https://carlos-ocampo.staff.upc.edu*

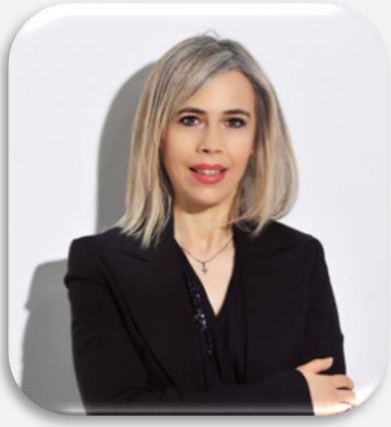

***Talk Title: "Event-Driven Partitioning for Non-Centralized Predictive Control in Economic Dispatch of Interconnected Microgrids"***

Wednesday October 23rd, 2024 – 9:20-10:20, Mexico City Time Zone (GMT-6, Central Time)
ROOM 4
Session Chair: Francisco Beltrán-Carbajal

**Short Biography:**
Prof. Ocampo-Martinez received his doctoral degree in control engineering from the Universitat Politècnica de Catalunya (UPC), Barcelona, Spain, in 2007. In 2007-2008, he held a post-doctoral position at the ARC Centre of Complex Dynamic Systems and Control, The University of Newcastle, Callaghan, NSW, Australia, and, afterward, at the Spanish National Research Council (CSIC), Institut de Robòtica i Informàtica Industrial, CSIC-UPC, Barcelona, as a Juan de la Cierva Research Fellow. Since 2011, he has been with the Automatic Control Department (ESAII), UPC, as an Associate Professor in automatic control and model-predictive control. He spent visiting periods at MIT, Cambridge, MA, USA; the University of Delft, Delft, The Netherlands; the University of Cambridge, Cambridge, U.K.; the University of Siena, Siena, Italy; and ITBA, Buenos Aires, Argentina. His main research interests include constrained model-predictive control, large-scale systems management (partitioning and noncentralized control), process control, and industrial applications (mainly related to the key scopes of water and energy, and smart manufacturing under the IoT framework).


**Abstract**:
This talk discusses a non-centralized model predictive control (MPC) approach to solve the economic dispatch problem in electrical networks. The proposed method operates in two stages. The first stage involves an event-triggered repartitioning mechanism that splits the network into a fixed number of non-overlapping sub-systems, namely microgrids in this context. The goal of this step is to create self-sufficient microgrids, capable of supplying their local loads using their own generation units. However, since the algorithm does not always guarantee that all microgrids will be self-sufficient, those that are not must form coalitions with neighboring microgrids. This coalition formation represents the second stage of the approach. By doing so, the overall economic dispatch problem is decomposed into smaller, coalition-based sub-problems, each of which is feasible. Although the solution derived from these sub-problems is feasible, it is sub-optimal compared to the centralized solution. Numerical simulations are provided to demonstrate the effectiveness of the proposed method.

## Plenary



# Spyretta Golemati, PhD

**Professor in National and Kapodistrian University of Athens**
**Greece**
https://www.embs.org/membership/chapters/distinguished-lecturers-program/distinguished-lecturers/spyretta-golemati/
CV

***Talk Title: "Exploring cardiovascular mechanics with ultrasound"***

Wednesday October 23rd, 2024 – 10:30-11:30 - Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: IEEE EMBS Student Chapter

**Short Biography**

Spyretta Golemati is Associate Professor of Biomedical Engineering in the Medical School of the National and Kapodistrian University of Athens, Greece. She holds a Diploma in Mechanical Engineering from the National Technical University of Athens, Greece, and the M.Sc. and Ph.D. degrees in Bioengineering from Imperial College London, UK. As visiting scholar/researcher, she visited the Ultrasound Elasticity Imaging Laboratory in Columbia University in the city of New York, USA (2013 and 2016), and the Centre for Visual Computing, Ecole Centrale de Paris (2013). She is alumna of the Fulbright Foundation-Greece. Her main research interests include image analysis of B-mode ultrasound images of the carotid artery, and the identification of novel indices of arterial mechanics and pathophysiology of atheromatous plaque. She has edited the book Cardiovascular Computing – Methodologies and Clinical Applications, published by Springer-Singapore in 2019. She has co-authored 37 papers published in international peer-reviewed journals, 15 book chapters, and 46 papers published in international scientific peer-reviewed conference proceedings. She is Associate Editor of Elsevier's journal Ultrasonics, Editorial Board member of ERJ Open Research and of BMC Cardiovascular Disorders, member of the Advisory Editorial Board of Ultrasound in Medicine and Biology, and Guest Editor of IEEE-JBHI. She is member of IEEE-EMBS, IEEE-UFFC, IEEE-WiE, the Technical Chamber of Greece, and the Hellenic Atherosclerosis Society. She is the Chair of the Greek chapter of IEEE-EMB (2020-today), co-chair of IEEE EMB Education committee (2022) and member of the IEEE EMB Chapter Development committee (2021-2022).

**Abstract:**

Cardiovascular mechanics investigates the movement of the heart and of peripheral and central arteries, resulting from the pressure and flow of blood. Mechanical properties of cardiovascular tissue are the result of the interplay between tissue composition and the forces exerted on it. Ultrasound technology allows assessment of cardiovascular motion and of tissue stiffness. Cardiovascular tissue motion can be calculated from conventional ultrasound videos if coupled with image analysis methods, while tissue stiffness can be assessed with ultrasound elastography. The clinical usefulness of cardiovascular mechanics lies in the fact that it is more sensitive to early tissue changes due to ageing or disease, compared to anatomical tissue properties. Keywords: ultrasound, mechanics, motion, elastic properties, heart, vessels, stiffness

## Plenary

# Jorge I. Poveda, PhD

**Professor in Electrical and Computer Engineering department at the University of California, San Diego, United States.**

***Talk Title: "Prescribed-Time Stability in Switched Systems with Resets: A Hybrid Dynamical Systems Approach"***

Thursday October 24th, 2024- 10:00-11:00, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dr. Francisco Beltrán-Carbajal

**Short Biography:**

Dr. Poveda obtained his M.S. and Ph.D. degrees in Electrical and Computer Engineering from the University of California, Santa Barbara, in 2016 and 2018, respectively, under the supervision of Andrew R. Teel. He also worked as Research Intern at the Mitsubishi Electric Research Laboratories in 2016 and 2017. Subsequently, he was Postdoctoral Fellow at Harvard University (2018) and Assistant Professor at the University of Colorado, Boulder (2019-2022). Since 2022, he has been Assistant Professor in the Electrical and Computer Engineering department at the University of California, San Diego, where he also holds an affiliate appointment in the Mechanical and Aerospace Engineering Department. Dr. Poveda is the recipient of various awards, including the CRII (2020) and CAREER awards (2022) from NSF, the Young Investigator awards from AFOSR (2022) and SHPE (2024), the Donald P. Eckman Award (2023) from AACC, and the Best Paper Award from the IEEE Transactions on Control of Network Systems (2023).

**Abstract:**

We consider the problem of achieving prescribed-time stability (PT-S) in a class of hybrid dynamical systems that incorporate switching nonlinear dynamics, exogenous inputs, and resets. By "prescribed-time stability", we refer to the property of having the main state of the system converge to a particular compact set of interest before a given time defined *a priori* by the user. We focus on hybrid systems that achieve this property via time-varying gains. For continuous-time systems, this approach has received significant attention in recent years, with various applications in control, optimization, and estimation problems. However, its extensions beyond continuous-time systems have been limited. In this talk, we address this gap and introduce a novel class of switching conditions for switching systems with resets that incorporate time-varying gains, ensuring the PT-S property even in the presence of unstable modes. The analysis leverages tools from hybrid dynamical system's theory, and a contraction–dilation property that is established for the hybrid time domains of the solutions of the system. We present the model and main results in a general framework, and subsequently discuss two different problems: (a) PT control of dynamic plants with uncertainty and intermittent feedback; and (b) PT decision-making in non-cooperative switching games using algorithms that incorporate momentum, resets, and dynamic gains.

## Plenary

# Kevin McComber, PhD

**CEO, Spark Photonics | Executive director, Spark Photonics Foundation United States.**

***Talk Title: "Empowering Semiconductor Innovation: Cultivating Technology and Education through Photonics"***

Thursday October 24th, 2024- 11:30-12:30, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

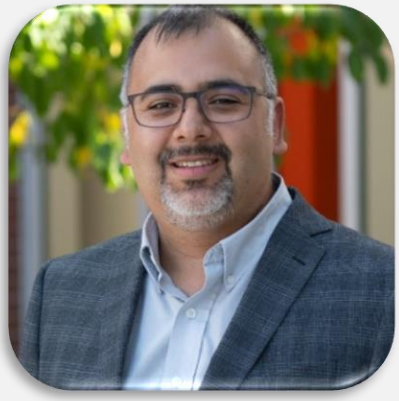
**Short Biography:**

Kevin McComber is the Co-Founder & CEO of Spark Photonics Design, a for-profit integrated photonics design services firm, and Executive Director of the Spark Photonics Foundation, a nonprofit STEM education, workforce development, and outreach organization. Dr. McComber previously worked at the Massachusetts Institute of Technology (MIT) in education and workforce initiatives, at Intel as a semiconductor process engineer, and in various business roles in financial services. He holds BS and PhD degrees from MIT in materials science and engineering.

**Abstract:**

Integrated photonics currently enables high-bandwidth data communications and holds the potential for widespread application in other areas such as quantum information science, chemical and biological sensing, precision navigation and timing, and machine vision. This talk will introduce the basics of integrated photonics and highlight some current work by Spark Photonics Design, and will then transition to a discussion of photonics and semiconductor workforce development at the K-12 and early college levels to inspire the next generation to pursue careers in the field.

## Plenary



# David Estrada, PhD

**Professor of Materials Science and Engineering at Boise State University and Co-Founder of INFlex Labs, Boise Idaho, United States**

***Talk Title: "Building the future of printed electronics based on 1D and 2D semiconductors"***

Friday October 25th, 2024- 10:00-11:00, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

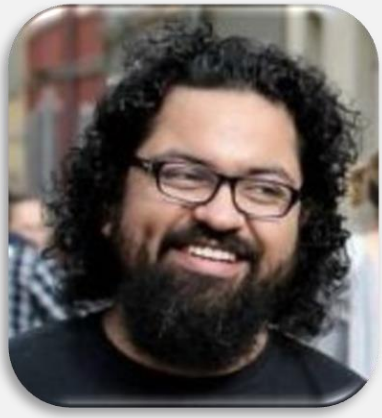
**Short Biography:**

David Estrada is originally from Nampa, Idaho. From 1998 to 2004 he served in the United States Navy as an Electronics Warfare Technician/ Cryptologic Technician – Technical. David achieved the rank of Petty Officer First Class in 2003 before receiving an honorable discharge and returning to Idaho to pursue his undergraduate education at Boise State University (BSU) where he was a Ronald E. McNair scholar. After completing his Bachelor of Science in Electrical Engineering from BSU in May of 2007, he began graduate studies at the University of Illinois at Urbana-Champaign (UIUC) under the direction of Professor Eric Pop. David received his Master of Science in Electrical Engineering from UIUC in 2009, and his Doctor of Philosophy in Electrical Engineering at UIUC in 2013. David then joined Prof. Rashid Bashir's Laboratory of Integrated Bio Medical Micro/Nanotechnology Applications as a Visiting Postdoctoral Researcher before moving to the Materials Science and Engineering Department at Boise State University. David is the recipient of the NSF and NDSEG Graduate Fellowships. His work has been recognized with several awards, including the Gregory Stillman, John Bardeen, and SHPE Innovator of the Year awards. His research interests are in the areas of emergent semiconductor nanomaterials and bionanotechnology.

**Abstract:**

This plenary lecture will delve into the latest developments in printed 2D materials, with an emphasis on their fabrication techniques and potential device applications. Additionally, it will provide a comprehensive overview of recent progress in MOCVD-grown $MoS_2$, showcasing its integration into advanced semiconductor technologies.

## Invited Lecture



# Anibal Pacheco, PhD

**Senior postdoctoral research in the Pervasive Electronics Advanced Research Laboratory, Universidad de Granada, Spain.**

***Talk Title: "Radiofrequency Circuits with Nano-Structured Material-Based Devices and Their Compact Modeling"***

Friday October 25th, 2024- 11:30-12:30, Mexico City Time Zone (GMT-6, Central Time)

ROOM 4

Session Chair: Dra. Arely Cano-Martínez

**Short Biography:**

Aníbal Pacheco-Sánchez is a senior postdoctoral research in the Pervasive Electronics Advanced Research Laboratory, Universidad de Granada, Spain. He received the Dr.-Ing. (Ph. D.) degree in Electrical and Computer Engineering from the Technische Universität Dresden (TUD), Germany in 2019 and the Master of Science degree in Telecommunications Engineering and bachelor degree in Electronics and Telecommunications from the Instituto Politécnico Nacional (IPN), Mexico, in 2011 and 2008, respectively. He worked as a postdoctoral researcher at the NANOCOMP group in Universitat Autònoma de Barcelona (UAB), Spain. He was a guest researcher at the Center for Advanced Electronics Dresden, Germany between 2012 and 2017. In 2023, he was a visiting researcher at Universitè de Lille, France and at Universidad de Granada, Spain. He is a member of the Electron Devices Society and the Nanotechnology Council, both of the IEEE, and he is a guest professor at IPN, Mexico since 2023. His present research interests involve advanced characterization, parameter extraction, compact and numerical modeling of emerging devices based on one-dimensional (1D) and two-dimensional (2D) materials for high-frequency (HF), energy-efficient and terahertz applications.

**Abstract:**

Physics-based compact models for emerging transistors are required to enhance the development of hybrid analog/radiofrequency circuits. This work presents the most recent modeling efforts for and circuit design based on emerging field-effect transistors with a strong emphasis on graphene technology. Proof-of-concept applications of devices based on graphene and other two-dimensional materials for radio-frequency circuits are reviewed and discussed. These include nanoswitches, power harvesters, amplifiers, phase-shifters, frequency multipliers and modulators.

# Papers abstracts

**ID2**

Antonio Saldivar-Mendez, Josue Gomez-Casas and America Berenice Morales-Diaz.

**Data-driven kinematic control with adaptive gains for a redundant robot**

**Abstract:** This paper proposes a control law with adaptive gains based on a data-driven kinematic model for a redundant robot, which is considered as an unknown, nonlinear and discrete-time MIMO system. The control law is tested for a trajectory tracking task of the end-effector. The Pseudo Jacobian Matrix computes an online equivalent kinematic model using the input and output signals. A neuro-fuzzy network structure is used to adapt the control gains using the updated Jacobian matrix for each end-effector's axis. The simulation results demonstrated a good performance of the control scheme considering the robot trajectory with and without disturbances during the task execution.

**ID5**

Rodolfo Villalobos-Salazar, Abimael Contreras-Carlos, Carlos A. Toro-Arcila and America Morales-Diaz.

**Hierarchical Drone Navigation Control for Ensuring Safety with Stationary Humans**

**Abstract:** Leveraging YOLOv8's segmentation capabilities, a drone is able to detect humans in its field of view to avoid collisions using only 2D information from a monocular RGB camera. To this end, in this work, the integration of a system composed of monocular ORB-SLAM2 and YOLOv8 is presented to enable autonomous drone navigation in indoor environments with human presence. This is achieved with a hierarchical control scheme that manages two tasks simultaneously: human avoidance and position regulation. Drone navigation uses a 3D map build with the ORB-SLAM2 technique. The human detection is done using the YOLOv8 deep learning approach and it's COCO database training. The system effectiveness is verified through experimental validation, where the drone encounters a human while navigating with a fixed height towards a target position defined in the map. Control stability is ensured with the Lyapunov approach. The results obtained represent a promising safe drone navigation system in indoor environments with a stationary human.

**ID6**

Sara Yousefi and Seyedreza Taghizadeh.

**AnyComputing: A Novel Architecture for Orchestrating Various Computing Paradigms for Adaptive Workload Management**

**Abstract:** The proliferation of physical objects and intelligent systems, along with their inherent differences, such as levels of device mobility, generated data volume, required storage memory, and complexity in data processing, presents a significant challenge in achieving real-time and optimal responsiveness to the Massive volume of sent requests from these systems. Depending on the nature of each request and its requirements, effective processing must be by available and suitable computational platforms. This situation necessitates the urgent development of novel ideas and frameworks in request orchestration and processing by suitable computational platforms to enhance system performance and efficiently utilize available computational resources. In this article, we propose an integrated computational architecture spanning from edge devices of users and intelligent things to cloud servers. This design encompasses the reception, processing, and response to various computational and storage requests, considering specific requirements, through computational units deployed within this span. Our objective in devising this architecture is to establish mechanisms for categorizing diverse computational requests from users and things, effectively allocating resources to them, thereby reducing response time, optimizing bandwidth utilization and other available resources, managing latency for real-time requests, and minimizing energy consumption in user devices and intelligent objects.

**ID10**

Erick Axel Martinez Ríos and Rogelio Bustamante-Bello.

**Parameter Selection of Generalized Morse Wavelets for Water Leakage Classification**

**Abstract:** Water leakage detection in water distribution networks is crucial to mitigating water scarcity. Machine learning algorithms have been utilized to generate models that detect water leakages by employing vibration, acoustic, flow, and pressure signals. In this sense, time-frequency methods have been widely employed to extract features or represent the signals for water leakage detection. Nevertheless, the challenge of using time-frequency analysis, such as the wavelet transform, is to select an adequate mother wavelet and its parametrization to represent the time-frequency information of the signal correctly. The selection of a mother wavelet is frequently performed arbitrarily or through trial and error, or the parameterization of the wavelet transform is not reported, hindering the studies' reproducibility. Using acceleration data, this paper proposed using the Heisenberg area and the Average Reconstruction Mean Squared Error (ARMSE) to select the Generalized Morse Wavelets (GMWs) parameters to perform waver leakage classification in looped and branched water networks. The generated scalogram was used to fine-tune the GoogLeNet to classify the water leakages in the two water networks. The results of this study showed that the use of the Heisenberg area and the ARMSE to set the parameters of the GMWs led to select a $\beta = 1.6667$ and 1 voice per octave for the looped water network and $\beta = 2$ and 2 voices per octave for the branched water network. Furthermore, fine-tuning the GoogLeNet with the generated scalogram shows a testing accuracy of 78.33\% for the looped water network and 76.25\% for the branched water network.

**ID15**

Israel Iván Lara Garcilazo, Venkata Krishna Karthik Tangirala and Arturo Maldonado Álvarez.

**Photocatalytic Degradation of Levonorgestrel by Sprayed ZnO Thin Films**

**Abstract:** Pure and Ni doped zinc oxide (ZnO) thin films were deposited by ultrasonic spray pyrolysis. The precursor used for the pure ZnO thin film was previously grinded and the doped film was doped 3%at. FTIR of both samples confirms the presence of Zn-O stretching vibrational modes that corroborate the presence of ZnO. XRD characterization confirms the presence of wurtzite zinc with a preferential orientation of (002) and (004) for the pure and doped ZnO thin films, respectively. SEM images show similar structures in both samples with mean lengths ~ 305.3 and 229.8 nm for the pure and doped ZnO, respectively. The photocatalytic performance of the samples was tested against a 3 ppm levonorgestrel solution under UV-C light irradiation (254 nm). After 120 min of irradiation, the degradation percentage obtained was 76.7% and 81.3% for the pure and doped ZnO thin films, respectively.

**ID16**

Cesar Solis, Sergio Isai Palomino and Hipolito Aguilar.

**Self-Tuning PID Controller for Serial Robots with Real-Time Functional Optimization**

**Abstract:** This paper presents an interesting application for Robust Extremum Seeking Algorithm (RESA) to a self-tuning PID controller for serial robots. The theoretical framework is presented to guarantee the stability, convergence of this proposal. The main advantage that can be found with this method is that it has an easy-to-implement structure and does not require strong mathematical conditions and allows minimizing a functional in real time, which is selected to reduce the error norm and its derivative, however there is the possibility of choosing it in another way. Finally to validate the theory we applied it to develop self-tuning PD controller for a SCARA robot.

**ID 18**

Tarek Berghout.

**Improved Anemia Medical Diagnosis on Complete Blood Count: Tuning Projected Long-Short Term Memory Layers with Coefficient of Determination**

**Abstract:** Anemia, characterized by a deficiency in red blood cells (RBCs) or hemoglobin (HGB), poses significant global public health challenges. Accurate diagnosis and classification of anemia types, crucially dependent on hemoglobin (HGB) level estimation, is essential for effective management and treatment planning. This study investigates the prevalence, severity, and demographic associations of various anemia types among 364 adult patients using publicly

available data from complete blood count (CBC) tests. The dataset includes 11 CBC attributes pivotal for anemia diagnosis, encompassing HGB levels and RBC counts. To address the complexities inherent in CBC data, such as variations in normal ranges based on age and gender, and challenges in data interpretation across diverse patient demographics, machine learning techniques are employed. Specifically, projected layers of long short-term memory networks (PLSTM) are utilized. These techniques require robust methodologies for data preprocessing, feature selection, and model optimization based on coefficient of determination R^2, prioritizing realism and the preservation of critical medical information. This approach ensures accurate predictive modeling of anemia types based on hemoglobin (HGB) levels, classified as mild, moderate, or severe according to World Health Organization (WHO) guidelines. Insights derived from this study, leveraging PLSTM over traditional LSTM networks, contribute to enhancing diagnostic accuracy and developing personalized treatment strategies for anemia. This underscores the role of machine learning in tailoring approaches to complex medical datasets, thereby advancing healthcare outcomes.

**ID19**

Rosa Nava-Sanchez, Gaspar Casados-Cruz and Arturo Morales-Acevedo.

**High conductivity copper iodide (γ-CuI) thin films deposited by a spin-coating technique**

**Abstract:** The preparation of p+ hole transport layers (HTLs) with high transparency and conductivity is an important step for the development of thin film electronic devices such as solar cells, thin film transistors, and photodetectors; especially, when the films are prepared by low-cost techniques such as spin-coating from a solution. In this study, the deposition of CuI thin films with appropriate properties, using a spin-coating technique, is explained. Single and double layers were obtained (thicknesses up to 75 nm). The material was formed by nanocrystals (27 nm) with a single plane orientation along the diagonal of the zinc-blende cubic lattice (FCC). The bandgap in average was 2.99 eV, assuring high transparency in the visible range. The conductivity was in the range from 0.05 to 0.1 (S/cm), with hole concentrations in the range from 2 to 4 × 10^19 cm-3, and mobilities around 3 cm^2/Vs, which correspond to high values for this material when prepared by spin-coating, achieved previously only when doping it with iodide. In addition, the morphological (coverage and uniformity) characteristics for the double layers are much better than those reported by other researchers.

**ID20**

Lamia Alam and Nasser Kehtarnavaz.

**Improving Identification of Defective Wafer Maps by Data Augmentation via Enhanced CycleGAN**

**Abstract:** In integrated circuit manufacturing, a wafer map represents a pattern of defective dies or chips on a wafer. In order to identify different defective wafer maps or patterns by a deep learning model, it is essential that a balanced number of samples of different patterns of wafer maps is used to train the model. In this paper, the Enhanced CycleGAN generative network is used to generate realistic defective wafer maps for which adequate numbers of samples do not exist. The identification of defective wafer maps is then carried out without and with such a data augmentation. Based on the public domain wafer map dataset of WM-811K, it is shown that our data augmentation improves the overall identification accuracy by 6% and 38% for the two test cases examined compared to the no data augmentation cases.

**ID21**

Benjamin Eduardo Aguilar Arce, Ingrid Gutiérrez Villegas and Gerardo Vera Juárez.

**Implementation of Computer Vision and Image Processing in Technovigilance at the National Institute of Cardiology Ignacio Chávez: Adenosine Vial Case**

**Abstract:** This article addresses a case of application of computer vision along with image processing for the detection of elastomers inside syringes (Coring effect) used in the administration of adenosine to patients of the service 1 of the Ignacio National Institute of Cardiology Chávez. An experimental setup consisting of a 0.3 megapixel camera, computer and MATLAB software is used for the detection of an elastomers of approximately 1 mm, being almost imperceptible to the human eye, also, we analyze the puncture area in adenosine vial and the puncture technique. An experimental setup is developed with a 0.3 megapixel camera (resolution of 640x480) and processing in MatLab which allows to determining

the puncture area in the adenosine elastomer vial, as well as detecting the dimensions of the fragments present within the analyzed syringes at a distance of 0.05 m. This tool is characterized with a standard instrument (vernier), finding the following characteristics: resolution of 0.08 mm, precision of 98%, accuracy of 97% and an error of +/- 0.2 mm. These figures of merit are appropriate for application in the present case. Additionally, we use a similar setup to determine the puncture angle at a distance of 0.3 m. This tool is characterized with a standard instrument (goniometer), finding the following characteristics: resolution of 1°, precision of 98%, accuracy of 95% and an error of +/- 2°. These figures of merit are suitable for application in the present case. Also, note that accuracy and error vary depending on the caliber of the needle. Thanks to the use of these techniques, it was possible to detect the dimensions and shapes of the elastomer fragments detected inside the syringes, as well as the analysis of the puncture technique. The use of computer vision and image processing techniques turns out to be a quantitative, objective tool with minimal alteration of the evidence, which allows us to conclude that the use of an incorrect puncture technique and incorrect needle calibers could be the main causality of the Coring effect. The results are promising for their implementation in future cases in technovigilance, as well as in the clinical area of medicine to minimize errors in medical practice, safeguarding patient safety, as well as in other areas of science. Additionally, it is a technique that complies the current regulations in which technovigilance is established in Mexico.

**ID23**

Tarek Berghout.

**Iron Deficiency Anemia Diagnosis for Young Children: Image-Driven Comparative Analysis of Recurrent and Projected Neural Networks**

**Abstract:** Iron deficiency Anemia (IDA) poses significant public health challenges, particularly in young children, necessitating efficient and non-invasive diagnostic methods. IDA is characterized by a decrease in red blood cell (RBC) count due to insufficient iron levels, leading to symptoms such as fatigue and impaired cognitive development, particularly prevalent among children in resource-limited settings. Traditional methods for IDA detection involve invasive blood tests, which are costly, time-consuming, and often impractical for pediatric populations. These methods are limited by their requirement for skilled personnel, the discomfort they cause to young children, and the potential for variability in results. Machine learning presents a compelling alternative, leveraging non-invasive imaging and automated analysis to provide fast and accurate diagnoses. This study explores the application of machine learning for diagnosing IDA using palpable palm images collected from hospitals in sub-Saharan Africa. The dataset comprises images of children aged five and below, categorized into anemic and non-anemic groups based on corresponding hemoglobin (HGB) values provided by laboratory tests. Techniques including image preprocessing, segmentation, feature extraction, and data augmentation were employed to enhance dataset quality and balance class sizes. Comparative analyses were then conducted using a set of recurrent networks, namely, Gated Recurrent Units (GRU), Projected GRU (PGRU), Long Short-Term Memory (LSTM), and Projected LSTM (PLSTM) models to assess diagnostic accuracy. All algorithms' hyperparameters were tuned based on generalization errors using Bayesian optimization. Results demonstrate the efficacy of GRU in accurately classifying IDA, with a Recall = 100 %, offering a promising approach for diagnosis in pediatric populations.

**ID25**

Kacha Kalinka, Hichem Ferhati, Adel Bendjerad, Fayçal Djeffal and A Benhaya.

**Effects of Ni/Cu Bilayer Structure On The Optical and Electrical Characteristics of Al-doped ZnO Thin-Film**

**Abstract:** The present study aims at investigating the impact of bimetal Ni-Cu intermediate layer on the performances of thin-film AZO-based structure, as alternative reliable broadband optical sensor. In this regard, this paper provides an in-depth experimental analysis of the Optoelectrical properties of AZO-Ni-Cu-AZO structures deposited on glass substrates for broadband (UV-Vis-NIR) photosensing applications. Employing RF Sputtering for the deposition process, we investigate the integration of Nickel (Ni) to enhance the reliability properties, particularly thermal and electromagnetical radiation effects, within the Aluminum Zinc Oxide (AZO) matrix. Moreover, the prepared structure (AZO-Ni-AZO) is re-engineered by introducing an ultrathin Copper (Cu) layer, in order to enhance the electrical properties and flexibility behavior of the sensor. The investigated AZO-Ni-Cu-AZO structure exhibits improved photodetectivity,

which makes it as an alternative for developing advanced optoelectronic devices for reliable, flexible and low-cost thin-film technology

**ID27**

Carlos Osorio Quero and Jose Martinez-Carranza.

**Physics-Informed Machine Learning for UAV Control**

**Abstract:** The integration of Dynamic Mode Decomposition (DMD) control with Physics-Informed Neural Networks (PINNs) offers a novel approach to enhancing UAV quadcopter control systems. This method leverages DMD techniques and PINNs to solve the Riccati equation, which is essential for precise UAV position estimation. By framing the UAV control problem within physics-based constraints, the approach ensures that the learned models adhere to the physical laws governing UAV dynamics. Utilizing a comprehensive dataset—including UAV flight parameters such as position, velocity, and control inputs—DMD extracts fundamental dynamic modes from the data, providing a reduced-order representation that captures the dominant UAV dynamics. This reduced representation is then incorporated into the PINN framework to accurately solve the Riccati equation. The combination of DMD and PINNs results in a robust control strategy that significantly improves position estimation accuracy and optimizes control performance. Real-time validation of this method was conducted in a Unity-based physics simulation environment, incorporating factors like gravity and perturbation noise. The results demonstrate substantial improvements in estimation accuracy and control stability compared to traditional methods.

**ID28**

Murat Bakirci and Irem Bayraktar.

**Assessment of YOLOv10 for Ship Detection in SAR Imagery under Open Ocean and Coastal Challenges**

**Abstract:** Ship detection from Synthetic Aperture Radar (SAR) images plays a crucial role in maritime surveillance and safety. This study focuses on evaluating the performance of the latest state-of-the-art YOLO algorithm, YOLOv10, for ship detection, particularly because it has not been tested on SAR images prior to this research. YOLOv10 was selected for its recent release and potential improvements over previous iterations. To assess its effectiveness, the algorithm is compared with earlier YOLO versions using SAR imagery. The dataset is categorized into two subsets: open ocean images and coastal images, where distinguishing ships from coastal structures presents a significant challenge. The advantages and limitations of YOLOv10 are thoroughly examined through a comparative analysis with its predecessors. Results indicate that YOLOv10 outperforms earlier versions in most scenarios, particularly excelling in open ocean environments. Although ship detection from SAR images is inherently difficult, YOLOv10 achieves promising Precision, Recall, and mAP values of 0.865, 0.813, and 0.792, respectively. Its performance in open ocean images exceeds these average values, highlighting YOLOv10's efficacy in maritime surveillance. However, performance in coastal images is lower, with YOLOv9 performing closely to YOLOv10 in these cases. The findings underscore YOLOv10's effectiveness for ship detection from SAR images, showcasing its enhanced ability to detect ships in challenging environments and emphasizing its relevance for future maritime applications.

**ID29**

Adriana Martínez-García, Irving Ríos-Valtierra, Victor Hernández-Valderrama, Jóse Gutiérrez-Gnecchi and Daniel Lorias-Espinoza.

**Prototype of USB Flexible Endoscope for Training Based on theTask of the Society of American Gastrointestinal and Endoscopy Surgeons Tasks: Simulation and design.**

**Abstract:** The article emphasizes the critical role of flexible endoscope handling in the training of gastroenterologist surgeons, while highlighting the limitations posed by workload and restricted access to surgical simulators. To address these challenges, the Society of American Gastrointestinal and Endoscopy Surgeons (SAGES) developed the Fundamentals of Endoscopy Surgery (FES) program, which assesses essential skills through tasks such as retroflexion, surgical target identification, and loop reduction. The EndoNavSkill 01 system, currently in the conceptual phase, includes a medium-sized gastric model, a flexible endoscope, and a computerized interface that provides real-time control, visualization, and data recording. The endoscope tip has two additional degrees of freedom (DOF) and a 20 mm

diameter. The tip is 150 mm longand has a working channel for 3 mm instrumentation. It has been tested with a commercial biopsy forceps. Preliminary tests demonstrated that the system achieved 180-degree retroflexion with half a turn of the control knobs, successfully visualizing the gastric cavity entry. Regarding precision, the endoscope's positional errors were recorded as 0.50% along the X-axis, 0.90% along the Y-axis, and 1.15% along the Z-axis. Additional metrics recorded included the time required to complete tasks, surgical target identification, extraction task, and the endoscope's path in coordinates 3D. EndoNavSkill 01 is a master's project currently in development and distinguishesitself by allowing the use of real instruments, unlike virtual simulators that rely on idealized conditions and are often prohibitively expensive. Although the prototype has met key design objectives such as achieving retroflexion and verifying the working channel's functionality, further testing and development are required to optimize the system and confirm its suitability for clinical environments.

**ID30**

Jessé de Oliveira Damião, Marcelo Antonio Pavanello and Michelly de Souza.

**Electrical Characterization of nMOSFETs from a 180 nm Commercial Technology at Low Temperatures**

**Abstract:** This article aims to present experimental results of nMOSFETs from a 180 nm commercial CMOS technology, with different channel lengths, operating at temperatures ranging from 80 K to 300 K. The source-drain resistance (RSD), threshold voltage (VTH), subthreshold slope (SS), low-field mobility (μ0), and the linear (θ1) and quadratic (θ2) mobility degradation factors were extracted. The extraction of RSD yielded an average value of 61.90 ± 3.83 Ω all devices and temperatures. Comparing all the devices, as the temperature decreased, VTH showed an increase in its value between 22.3 % and 33.9 %; SS showed a decrease between 59.7 % and 62.1 % of its value; μ0 increased 162.4 % for the shorter device and 243.2 % for the longer device; θ1 varied less for longer devices; and θ2 showed more variations in its values, being less intense in shorter devices. Analyzing the channel shortening, the rate of change dVTH/dT showed, in magnitude, a decrease from 0.696 mV/K to 0.561 mV/K, the rate of change dSS/dT showed an increase from 0.197 mV/(dec·K) to 0.223 mV/(dec·K), and the ZTC was from 0.67 V to 0.77 V.

**ID31**

K. Kacha, Adel Bendjerad, Hichem Ferhati, Fayçal Djeffal and A Benhaya.

**Optical and Electrical characteristics of Flexible AZO-Cu-AZO Structure Prepared Via RF sputtering Technique**

**Abstract:** This article provides an in-depth analysis of the optical and electrical characteristics of a multilayer film consisting of AZO-Cu-AZO, which was formed using RF magnetron sputtering. The film has a thickness of 40 nm for both AZO layers and 10 nm for the middle Cu ultra-thin film. The optical characterization shows that the material has a wide range of wavelengths that it can transmit, from 442 nm to 778 nm. This range covers most of the visible and near-infrared spectrum. The material has a peak transmittance of around 70%, which suggests that it could be used as a transparent coating for optoelectronic applications. Hall effect characterization reveals a significant abundance of charge carriers of the n-type, with a concentration of 10 21 cm-3 and a good recorded electron mobility. The results indicate that the AZO-Cu-AZO layer exhibits a high level of electrical conductivity while also preserving a good optical transparency. Moreover, the economic benefits and mechanical flexibility of this structure indicate its potential use in flexible portable electronic devices and other applications. The results emphasize the significance of improving deposition methods in order to get the highest possible material performance for optoelectronic applications.

**ID32**

Andrey Sarahy Santiago Rosales, Gerardo Marcos Tornez Xavier, Merlina Angélica Navarro Villanueva, Oliverio Arellano Cárdenas, Luis Martín Flores Nava and Felipe Gómez Castañeda.

**Digital Emulation System for Combined Cycle Plants based on Machine Learning**

**Abstract:** In this work, we present the development of an emulator capable of accurately simulating the expected results or behavior of a combined cycle plant, using the machine learning framework (ML), specifically neural networks. These networks can predict the electrical power (EP) that the system can produce based on four input parameters: relative humidity (RH), ambient pressure (AP), ambient temperature (AT), and vacuum (V). Once the neural network was

optimized, it was implemented at the hardware level in an FPGA (Field Programmable Gate Array) device. This allows the emulator to make predictions for different locations, provided the necessary parameters are adjusted.

**ID33**

Marina Montes-Partida and Ernesto Lopez-Mellado.

**Accuracy Measures for Timed Petri Nets**

**Abstract:** The paper is in the scope of quality assessment of discrete-event process models; accuracy measures of timed Petri nets (TPN) are proposed. A TPN N is assessed concerning a set of dated event sequences Lt, where the occurrence instant of every event is recorded. The class of TPN addressed assigns real-valued time parameters to transitions as a single value D(tj) or an interval of values I(tj); a metric is developed for each kind of timing. The accuracy of N is evaluated on [0, 1] by measuring the deviations between the actual event occurrences in Lt and the expected firing instant of transitions in the TPN.

**ID34**

R. Ouchen, I. Rahmani, H. Ferhati and F. Djeffal.

**Performance Assessment of Nanoscale SiGe High-k Negative Capacitance Junctionless GAA MOSFETs**

**Abstract:** Our approach in this paper aims at investigating the impact of combining high-k dielectric materials with ferroelectric materials in silicon-germanium (SiGe) Junctionless Gate-All-Around (GAA) Field-Effect Transistors (SiGe-High-k-NCJLGAA-FETs). This offers unique advantage and can lead to a significant improvement in device performance. The combination of high-k dielectrics and ferroelectric materials enhances the electrical properties by providing better channel electrostatic behavior. The electrical performance of the considered device (SiGe-High-kNCJLGAA-FETs) is investigated numerically using ATLAS 2D simulator, where numerically modeling of surface potential and subthreshold swing, including short channel are performed. The effect of ferroelectric material is introduced using accurate analytical modeling. The effect of the Ge mole fraction on the device electrical performance is investigated. In addition, the influemnce of various high-k dielectric materials on the device performance is analyzed. A minimum swing factor (SS) of 31.2 mV/decade is recorded for L=30 nm using the doped-hafnium oxide as ferroelectric material and SiGe channel with TiO2 gate oxide. These enhancements make the optimized transistor device highly approriate for usage in lowpower and digital nanoelectronic applications.

**ID35**

Murat Bakirci and Irem Bayraktar.

**Comparative Performance of YOLOv9 and YOLOv10 for Vehicle Detection towards Real-Time Traffic Surveillance with UAVs**

**Abstract:** Intelligent transportation systems (ITS) have gained significant traction since the 1980s and 1990s, driven by technological advancements and increasing urbanization, which have led to severe traffic and transportation challenges. UAV systems, with their superior imaging capabilities, offer critical solutions for real-time traffic monitoring and management, surpassing traditional monitoring systems. In this context, object detection, a key sub-field of deep learning, is crucial, and the YOLO algorithm stands out for its speed and efficiency. This study provides a detailed performance comparison of the YOLOv9 and YOLOv10 algorithms for vehicle detection using traffic images captured by UAV systems. Datasets were created from these UAV-based traffic images, and the performances of both algorithms were measured and compared. The results were analyzed to highlight each algorithm's strengths and limitations. Additionally, the study discusses qualitative aspects, including advantages, disadvantages, and potential improvements for both algorithms in aerial traffic monitoring.

**ID36**

Alfredo Bayu Satriya, Myles Joshua Tan and Yong-Kyu Yoon.

**Machine Learning-Based Thickness Estimation of Abdominal Fat and Muscle Using Simulated Radio Frequency Scattering Parameters**

**Abstract:** The estimation of three abdominal tissue thicknesses, namely subcutaneous fat (SAT), muscle tissue (MT), and visceral fat (VT), was performed using radio frequency (RF) signal measurement and machine learning algorithms. The scattering parameter data were collected from simulations of a planar multilayered model of the human abdomen, with parametric analysis on each layer's thickness. Various models, incorporating combinations of several frequency bands and 120 data points, were investigated. The results showed that polynomial regression (PR) and ridge polynomial regression (RiPR) using scattering parameters from frequency bands of 300 MHz, 400 MHz, 500 MHz, and 1 GHz performed the best among other models. PR (300 MHz, 400 MHz, 500 MHz, and 1 GHz) achieved RMSE values of 0.71 mm for SAT estimation, 1.2 mm for MT estimation, and 1.17 mm for VT estimation. RiPR (300 MHz, 400 MHz, 500 MHz, and 1 GHz) achieved RMSE values of 0.35 mm for SAT estimation, 1.57 mm for MT estimation, and 1.7 mm for VT estimation. However, these results indicated a high error percentage for VT estimation, as VT had a mean thickness of only 3 mm. The results also showed that the deeper the tissue, the more prone the estimation was to error. This is due to the nature of electromagnetic reflection and transmission within a multilayered medium, which affects the scattering parameter measurement. While the models perform well for upper tissue estimation, further improvements in the model, feature selection, and physical solutions are necessary to enhance the accuracy of deeper tissue estimation.

**ID37**

Nafisa Zarrin Tasnim, Aoxin Ni, Edward Lobarinas and Nasser Kehtarnavaz.

**Personalization and Smartphone Implementation of ADRO Hearing Aid Amplification by Bayesian Machine Learning**

**Abstract:** The amplification function of hearing aids is normally prescribed based on population-based prescriptions, often overlooking individual hearing needs. Previous studies have shown that personalization or individualization of prescriptive amplification can lead to improved hearing. This paper introduces a personalized amplification strategy that applies a Bayesian learning personalization algorithm to the Adaptive Dynamic Range Optimization (ADRO) prescription. The personalized ADRO amplification strategy is then implemented on a smartphone platform as an app that can be deployed in the field or in real-world audio environments. The results of hearing preference experiments from six participants with hearing loss are reported. The results, on average, indicate higher preference for the personalized ADRO relative to the standard ADRO prescription.

**ID38**

Lorenz Josue Oliva-Gonzalez and Rafael Martínez-Guerra.

**Fractional-Order Newton-Like State Estimator for Discrete-Time Nonlinear Systems**

**Abstract:** In this paper, we discuss the state estimation problem for discrete-time nonlinear systems under a zero search approach. In this sense, a state estimator based on the fractional-order extension of the well-known Newton's method is designed. The properties presented by this estimator are inherited from the aforementioned method, in addition, compared to the classical Newton's method, the fractional order extension has significant advantages such as fewer iterations to achieve convergence and wider regions of attraction for the zeros. On the other hand, considering other estimation methods, the presented approach offers a better performance in general.

**ID39**

Aleksey Gvozdarev and Tatiana Artemova.

**Performance Analysis of an Amplify-and-Forward Relay-Assisted Communication in the Presence of Double-Rayleigh Fading and Shadowing**

**Abstract:** Double-Rayleigh (dR) statistical fading channel model has been proved to be capable of capturing specific propagation conditions in urban microcellular communications. The potential application scenarios of such systems include the utilization of the intelligent transportation system infrastructure, e.g., the Roadside Units (RSU), as relay nodes bridging the nearby users with telecom providers. Thus, the specific traits of V2I communications must be assumed. Recently, a novel modification of dR models (i.e., the second order scattering fading model with fluctuating line-of-sight (fSOSF)) was introduced for wireless communications. Thus, the current research presents the performance analysis of a relay-assisted communication system with an Amplify-and-Forward (AF) protocol functioning in the presence of a channel with fading corresponding fSOSF statistical model. The system performance was studied in terms

of the outage probability, the channel ergodic capacity, and the average error rate. The presented results of the extensive numerical analysis and simulation demonstrated several specific effects that can be exploited to increase system performance.

**ID42**

Areli Cabrera Oros, Jonathán de Jesús Estrella Ramírez and Juan Carlos Gómez Carranza.

**Late Fusion of Text and Images for Predicting User Interests in Pinterest Social Network**

**Abstract:** Due to the large amount of information on social media, predicting user interest becomes crucial for various tasks including the improvement of the user experience in these platforms. This paper introduces a late fusion model designed to predict one of 29 predefined categories (considered as the user interests) established by Pinterest for any new pin uploaded by a user. A pin is an information unit with two components: an image and a short text comment. Given a new pin, the proposed model performs a multimodal classification by transforming and classifying each data modality (image and text) independently and then fusing the category probabilities with a weighted sum to predict the final categories for the pin. To test the validity of the fusion, a set of experiments is conducted analyzing and comparing the performance of different state-of-the-art deep learning transformations for each modality; and using a logistic regression model for classification. Additionally, the fusion is evaluated under different values for a weighting factor, in charge of assigning less or more importance to each data modality in the final decision. The experiments are carried out over a dataset composed of 29,000 pins collected directly from the Pinterest website. The results show that the late fusion of image and text representations increases the accuracy of predicting user interests when compared to the use of each single modality.

**ID43**

Daniel Apolinar Amaro Caraveo, Arturo Velasco Hernández, Claudia Elena Pérez García, José Santos Cruz, Francisco Javier de Moure Flores and Sandra Andrea Mayén Hernández.

**Novel Synthesis of Bi2MoO6 Thin Films for Sunlight-driven Photocatalysis**

**Abstract:** In this study, Bi2MoO6 thin films were developed for use as a photocatalyst in the degradation of methylene blue in the presence of solar energy. The thin films were synthesized by a sol-gel method followed by dip coating. The effects of various sintering heat treatment temperatures on the structural, optical, and photocatalytic properties of the thin films were investigated. X-ray diffraction and Raman spectroscopy demonstrated the presence of the semiconductor. UV-Vis absorption and reflection spectroscopy was used to obtain the bandgap of the films. The photocatalytic performance of the thin films achieved high bleaching rates. Notably, the film sintered at 450 ºC exhibited a higher degradation rate during the initial hours of the experiment, highlighting its potential for efficient photocatalytic applications.

**ID44**

Aoxin Ni, Edward Lobarinas and Nasser Kehtarnavaz.

**Field Deployment of Personalized DSLv5 Hearing Aid Amplification by Bayesian Machine Learning**

**Abstract:** This paper presents a real-time smartphone app that enables field deployment of a personalized DSLv5 amplification strategy based on a multi-band Bayesian machine learning algorithm. This implementation allows for the personalization of DSLv5 in real-world audio environments. The app includes a training and a testing session module. The training session allows reaching an optimum set of personalized gain values across a number of frequency bands. This is achieved by conducting paired audio comparisons by the user in a time-efficient manner. The testing session assesses comparisons between the personalized gain setting versus the standard DSLv5 prescription gain setting. The details of the steps taken to achieve this real-time implementation on smartphone platforms are presented. The results of a clinical experiment conducted on five participants with hearing loss show that the personalized settings on average are preferred over the standard settings by a factor of six times.

**ID45**

Víctor Rodríguez, Luis Pizano and Omar Longoria.

**Application of Machine Learning Techniques to Characterize AI Benchmarks using Hardware Events**

**Abstract:** Nowadays, in a dynamic data center landscape, effective distribution of computational resources is crucial to achieving peak performance and cost-efficiency. This study addresses the challenge of distinguishing artificial intelligence workloads from other tasks within data centers, focusing on optimizing their execution on specialized AI accelerators like GPUs. By integrating machine learning algorithms with hardware performance counters, the study profiles AI workloads and develops predictive models. These models enable accurate detection and optimization of AI compute tasks, aiming to enhance resource allocation and overall performance in modern data center environments. The study achieves 100\% precision in distinguishing AI / ML compute workloads from other benchmarks in the proposed experiments, underscoring its effectiveness in improving data center efficiency and productivity.

**ID46**

José Castro-Gómez, Omar Hernandez, Boubekeur Targui, Guillermo Valencia-Palomo and Maria-Eusebia Guerrero-Sánchez.

**Glucose Estimation In A Diabetes Mellitus Virtual Patient With Sampled Signal And Input Delay**

**Abstract:** This paper presents a control strategy for blood glucose regulation in the presence of an unknown time-varying delayed input. The proposed control scheme is based on an observer-based linear parameter varying (LPV) control with an {$H_\infty$} criterion, designed for the Bergman minimal model (BMM) for type 1 diabetes mellitus patients. This control strategy regulates glucose levels in response to meal intake. A novel LPV system representation is used to mitigate the inherent conservativeness of the nonlinear system. The observer employs an event-triggered (ET) strategy to avoid unnecessary signal updates, enabling the estimation of the current state vector despite the delayed input, even when the delay is relatively long. Consequently, the control law ensures good performance despite a long unknown delay. The observer-based control scheme is validated under various meal disturbances and unknown delay.

**ID47**

Carlos Adolfo Cardenas Flores, Marco Antonio Silva Maldonado, Jesus Emiliano Chavez Garcia, Jesus Adan Ibarra Castro, Reyes Apolonio Castro Corral and Marcos Eduardo Cruz Victorio.

**Development of wind speed forecast models using Artificial Intelligence in Mexicali**

**Abstract:** This paper studies the application of artificial intelligence (AI) techniques for wind prediction in renewable energy systems using Genetic Algorithms (GA), Particle Swarm Optimization (PSO), and Transformers. The GA model, using data from an on-campus meteorological station, achieved low Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values, indicating high accuracy. PSO and Transformer models were trained with online datasets. The PSO model optimized ARMA coefficients with p = 8 and q = 6, while the Transformer model captured long-term dependencies. Due to different data sources, a direct comparison with GA was not feasible. The results provide detailed performance metrics and insights into the applicability of PSO and Transformers for real-time wind prediction.

**ID48**

Ali Alouache.

**Feature Selection using Teaching-Learning-Based Optimization Algorithm for Classification of Remote Sensing Images**

**Abstract:** This paper investigates feature selection for data dimensionality reduction in the binary classification of high-resolution remote sensing images. For this aim, a Teaching-Learning-Based Optimization (TLBO) algorithm is used within a wrapper feature selection (WFS) framework to pick the optimal features for the classification. In this work, the TLBO is used in conjunction with the support vector machine (SVM) classifier to constitute a machine learning paradigm. Compared to other evolutionary optimization algorithms, the proposed TLBO framework is characterized by less computational effort and no algorithm-specific parameter requirements. In the end, experimental tests are conducted to show the effectiveness of the proposed TLBO-based WFS approach by using multi-spectral data from Earth Observing-One Advanced Land Imager. The comparative results demonstrate the advantages of the proposed TLBO algorithm in achieving high classification accuracy in comparison to the genetic algorithm (GA) and particle swarm optimization (PSO).

**ID49**

Asma Dekkiche, M. O. Bellouber, Hichem Ferhati, K. Dibi and Fayçal Djeffal.

**Novel Ultraviolet Phototransistor Design Based On SnO2 Thin-Film Combined With Surface Ag Nanoparticles**

**Abstract:** This study investigated a new ultraviolet UV phototransistor structure employing SnO2 thin-film and plasmonic Ag nanoparticles (NPs). The main objective is to enhance the photogeneration capability in the active layer to achieve enhanced responsibility. Numerical model is developed for the device under examination and the photoresponse characteristics of the device are extracted. Utilizing a 3-D FDTD approach, the optical properties of SnO2 thin-film coated with Ag NPs are explored, revealing enhanced UV-absorbance capabilities attributed to localized surface plasmon resonance effects (LSPR). The effect of the NPs radius and spacing on the device performance is also analyzed. It is revealed that the proposed device can enhance the device UV photodetection properties offering a high current ratio of 90 dB. This innovative approach using cost-effective SnO2 active layer decorated with Ag NPs, significantly improves absorption capability of UV laght, offering a promising avenue for the development of alternative phototransistors for optical wireless communication systems (OWCS).

**ID50**

Federico Augusto Trampe-Torija, Francisco Beltrán-Carbajal, Jorge Ramírez-Muñoz and Mario Sampedro Cruz.

**Non-linear Model based Trajectory Tracking Control for Drying Process of Spirulina platensis and Red Chili in a Type-Tunnel Dryer**

**Abstract:** In this paper, a new control strategy for drying process was developed to control the product temperature in a type tunnel dryer. A two-stage control was developed to track the temperature trajectories of product and air using a Bezier curve at different setpoints, i.e., 50 °C for Spirulina platensis and 65 °C for Red Chili. The results demonstrate that the proposed control strategy leverages the heat supplied to the first product to enhance the heating performance of the second product. Furthermore, the use of a nonlinear model ensures that the tracking error tends to zero. Additionally, inherent disturbances in the model were considered in the second stage of the control to track the trajectory of the air temperature. Even when accounting for these disturbances, the control strategy is capable of effectively tracking the trajectory.

**ID51**

Francisco J. Cano, Odín Reyes Vallejo, Rocío Magdalena Sánchez Albores, Ashok A., Fernández Vázquez Vázquez, Salvador Escobar, Arturo Fernández Madrigal and Sebastian P.J..

**Adsorption of dyes by charcoal and activated charcoal from Moringa Oleifera leaves**

**Abstract:** This study evaluates the adsorption efficiency of dyes (methylene blue, malachite green, and rhodamine B) on charcoal and activated charcoal under controlled conditions. Significant variations in adsorption were observed which can be attributed to the molecular structure of the dye and the surface properties of the adsorbent. Malachite green showed the highest adsorption on inactivated charcoal, followed by methylene blue and rhodamine B. Activation of charcoal increased the adsorption capacity for all dyes, especially for methylene blue and rhodamine B, due to the introduction of oxygenated functional groups. Kinetic studies showed that the adsorption conformed to the pseudo-second-order model. The results suggest that activated charcoal is a promising material for dye removal, especially for those with lower initial affinities.

**ID52**

Nirvana Cinnereth Amparan-Ortega, Juan Alberto Ramirez-Quintana, Mario Ignacio Chacon Murguia and Alma Delia Corral-Saenz.

**Deep Neural Network Evaluation for Emotion Recognition through Facial Expressions Analysis**

**Abstract:** Emotion recognition through facial expressions is paramount in marketing, healthcare, affective computation, and security applications. This research evaluates Deep Neural Network architectures for emotion recognition based on facial expression images and discrete emotion classification. The datasets used are JAFFE and a custom dataset. The

selected Deep Neural Networks are VGG16, InceptionV3, ResNet50, Transformer model, VGG16 with LSTM and VGG16 with a Transformer. The Networks use transfer learning with pre-trained ImageNet weights. Results show that VGG16 outperforms other models in accuracy for both datasets, while hybrid models like VGG16 with Transformer show lower accuracy. These results indicate that further fine-tuning and exploration of these architectures are necessary. Investigating different methods to combine the strengths of each architecture could lead to better outcomes. This research highlights the strengths and limitations of each architecture, guiding future advancements in emotion recognition technology.

**ID53**

Giovanni Almeida Matos, Jaime Calçade Rodrigues, Michelly de Souza, Mikael Cassé, Sylvain Barraud, Olivier Faynot and Marcelo A. Pavanello.

**Experimental Decomposition of the Carrier Mobility in the Conduction Planes of 2-Level Stacked Nanowires**

**Abstract:** This paper investigates the separation of the drain current components in top-bottom and sidewall currents, and the extraction of their respective low-field mobility in two-level stacked nanowire nMOSFETs. The study presents a detailed analysis of carrier transport in different crystallographic planes, emphasizing the anisotropy in mobility due to variations in sidewall roughness induced by the etching process. Devices with variable fin widths (WFIN) were measured. The effective mobility and the mobility degradation factors were extracted using the Y-function method. This study provides insights into the optimization of process and device modeling for stacked nanowire MOSFETs.

**ID55**

Donaldo Francisco Vega Lagunas, Arturo Vargas-Olivares, J. Enrique Chong-Quero, Héctor Cervantes-Culebro, Carlos A. Cruz-Villar, Laura Curiel and Samuel Pichardo.

**Evaluation of Segmentation Quality in Magnetic Resonance Images using Singular Value Decomposition: A Feasibility Study**

**Abstract:** In the present research work, the use of Singular Value Decomposition (SVD) is investigated as part of an evaluation metric for the segmentation quality of regions of interest (ROI) in magnetic resonance imaging (MRI) used in an experiment of High-Intensity Focused Ultrasound (HIFU) therapy. Accurate segmentation is critical for clinical and research applications in computer vision, and current evaluation methods have limitations in sensitivity to the shape of segmented objects. A review of existing cardinality-based and distance-based metrics was conducted to analyze their advantages and limitations in the context of medical image segmentation. This analysis underscored the need for a more robust and shape-sensitive evaluation metric. SVD is introduced as a promising tool for assessing segmentation similarity to corresponding ground truth (GT) in therapy planning images through fundamental component comparison and analysis. The results obtained were compared with existing evaluation metrics, and findings suggest that SVD enhances sensitivity to object shapes in medical image analysis, potentially improving segmentation quality assessments, clinical diagnostics, and treatment planning by providing detailed insights into image structures, ultimately benefiting patient outcomes. Future work will focus on singular vector analysis to identify common spatial features between GT and segmented images, revealing specific pattern disparities and preserved characteristics.

**ID56**

Víctor Reza, Jorge Torres and Jesus Guerrero.

**A Continuous-Discrete ADRC for LTI Systems under Nonuniform Discrete Measurements and External Disturbances**

**Abstract:** Due to the absence of continuous measurements, designing and analyzing robust controllers or observers for dynamic systems under discrete measurements and external disturbances are crucial topics. The active disturbance rejection controller is an algorithm that estimates and rejects these external disturbances to guarantee robust stability in a closed loop within a dynamical system. However, it must be modified to perform well under discrete measurements. In this work, a continuous-discrete active disturbance rejection controller is designed and analyzed with a time-delayed approach to guarantee asymptotic stability for linear time-invariant systems under nonuniform discrete measurements. Hence, the controller based on an observer is coupled with an output predictor, such that linear matrix inequality

sufficient solvability conditions are given, allowing to tune the algorithm gains. Lastly, the proposed algorithm is illustrated through an academic example.

**ID57**

Fernando Evier Lopez Perez and Jose Cruz Nunez Perez.

**FPGA Emulation of the Physical Layer of an 802.11n-Based Transceiver**

**Abstract:** The IEEE 802.11n standard has revolutionized the wireless communications by significantly enhancing the capabilities of wireless local area networks. This article provides an overview of the physical layer of the IEEE 802.11n standard, focusing on its advancements and the benefits it brings to wireless communications. Also, this paper aims to evaluate the functionality of the physical layer, known as PHY, of the IEEE 802.11n standard using an FPGA board. To achieve this, the transmission and reception processes are reconstructed using the techniques required by the standard, including binary convolution, quadrature amplitude modulation (QAM), data interleaving, and orthogonal frequency division multiplexing (OFDM).

**ID59**

Juan Federico Ramirez Rios, Jose Juan Aviles Bravo, Sergio Alfonso Pérez García, Mario Moreno Moreno, Juan Ramón Ramos Serrano and Alfredo Morales Sánchez.

**Luminescent Defects in ZnO Thin Films: Effect of the Deposition Temperature and Thermal Treatment**

**Abstract:** In this work, ZnO thin films were deposited by RF magnetron sputtering at substrate temperatures ranging from 100ºC to 700ºC. The Williamson-Hall's approximation through the uniform stress deformation model (USDM) allowed the estimation of the stress and the size of the wurtzite crystal phase in these films. The sample deposited at 700 ºC exhibited the best crystallinity; then, it was subjected to thermal treatment at 900 ºC and 1000 ºC. This annealing process allowed to observe a relationship between the intensities of (103)/(002) XRD peaks with the visible/UV ratio photoluminescence peaks. This observation allows to estimate that the intensity of non-basal plane (103) is related to the generation of oxygen vacancies (VO) defects in the ZnO films.

**ID60**

Juan de Dios Ortiz Alvarado, Juan Carlos Rodríguez Sierra and Mario Josué Aguilar Méndez.

**Operating Conditions for Performance Improvement of Paired Emitter Detector Diode in Optical Measurements Based on Photocapacitance Discharge**

**Abstract:** The paired emitter detector diode (PEDD) configuration has been applied as an effective option for the implementation of optical measurements systems, since this scheme can be easily implemented in a microcontroller and with a reduced number of components. In this work, an evaluation of the effect on the performance of the measurement system based on photocapacitance discharge of PEDD was performed by modifying the clock frequency of microcontroller, and current supply of emitter LED for light intensity control. These experiments were carried out in turbidity measurement tasks in reference standard samples, and in estimation of biomass concentration in liquid suspensions of the microalgae Spirulina platensis. The results obtained indicates that the sensitivity of the measurement system depends on the light intensity of the LED emitter, as well as the accuracy of the readings is determined by the clock frequency of the microcontroller and suggest that these shall be considered for measurement system based in PEDD configuration.

**ID61**

Francisco-Javier Moreno-Vazquez, Felipe Trujillo-Romero and Amanda Enriqueta Violante Gavira.

**Enhanced Fuzzy Inference System for PM10 Concentration Prediction Using Genetic Algorithms**

**Abstract:** This research introduces an enhanced Fuzzy Inference System (FIS) by integrating Genetic Algorithms (GA) to optimize the rule set. The proposed GA+FIS model is applied to forecast PM10 concentrations in the Metropolitan Area of the Valley of Mexico (ZMVM). To validate its effectiveness, the GA+FIS model is compared with two robust machine learning models, XGBoost and LightGBM, regarding their performance in PM10 concentration prediction. The results

demonstrate that the GA+FIS model surpassed both XGBoost and LightGBM models, achieving an RMSE of 3.500632, R2 of 0.888926, and MAE of 2.759147. Notably, the GA+FIS model exhibited the closest alignment between predicted and actual PM10 concentrations, with an ideal slope of 0.97, indicating superior accuracy compared to LightGBM (slope = 0.80) and XGBoost (slope = 0.75). Across sampled instances, the GA+FIS model consistently aligned well with observed data points, underscoring its robustness in capturing complex relationships within the dataset.

**ID62**

Odin Reyes Vallejo, Rocío Magdalena Sánchez Albores, Roliber Escobar Velazquez, Clara López Aguilar, Francisco J Cano, Ashok A., José Escorcia García and Pascual Bartolo Pérez.

**Adsorption of Malachite Green on CaO-ZnFe2O4 Composite Derived from Agroindustrial Waste**

**Abstract:** This study focuses on the synthesis of a CaO-ZnFe2O4 composite derived from waste materials such as eggshell-derived CaO and ZnFe2O4 via a combustion process using orange peel as fuel. The composite was prepared through mechanical milling, sonication in ethanol, and annealing. Structural, morphological, and surface characterizations were conducted using X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and Brunauer-Emmett-Teller (BET) analysis, confirming the successful formation of the composite. The material exhibited high efficacy in removing malachite green dye through adsorption studies, revealing a significant capacity for dye removal. Kinetic modeling based on the pseudo-second-order equation indicated that the adsorption process is driven by chemisorption. Additionally, the adsorption process was found to be endothermic, as the removal of malachite green increased with rising solution temperatures.

**ID64**

José Manuel Ramírez Puente, José Manuel Rivera Garnica and Cesar Augusto Garcia-Isáis.

**Measuring hardness system based on image processing**

**Abstract:** In this work, we developed a system to determine the hardness of a metallic material. The method provides the Brinell hardness value through image analysis, a microscope, and mechatronic elements. The system consists of a microscope with an attached camera where the amplification factor is fixed. The system modifies the height of the microscope to focus the tested object through the movement of a stepper motor, the motor is stopped when the edge detection of the image is maximum. Once the microscope is correctly focused, an image of the indentation is captured by the camera and analyzed using the Hough transform for circle detection. Finally, the hardness value is obtained using the diameter detected.

**ID65**

Yoltic Uriel Palomino Ortega, Marco Antonio Hernández Alanis, Gabriel Sepúlveda Cervantes, Adrián Octavio Ramírez Morales and Blanca Tovar Corona.

**Neurofeedback training system to induce concentration states using virtual reality**

**Abstract:** Concentration is particularly important in our daily life either in academic or professional activities to reach goals and complete tasks efficiently. The present document proposes a neurofeedback training system implemented in a real-time, manipulable Virtual Reality environment. The attention coefficient (beta/theta ratio) was calculated from electroencephalographic signals to induce a state of concentration through visual feedback stimuli based on brain attention signals in a group of three university students. Over eight sessions, participants engaged in five cognitive virtual activities aimed at maintaining attention to complete each task. Signals were acquired in real time in all sessions using the Muse® headband, with electrodes placed at TP9, TP10, AF7, AF8, and FPz, from the 10-20 system. These were preprocessed to isolate beta and theta waves, which are related to attention. To determine participant attention, the power spectral density was calculated using the Welch method in beta and theta waves to compute the attention coefficient. The system's effectiveness was evaluated using the Test of Variables of Attention (TOVA) before and after the sessions.

**ID66**

Francisco Javier Cano, Odin Reyes Vallejo, Ashok Adhikari, Sandrine Coste, Velumani Subramaniam, Abdelhadi Kassiba, Iouri Koudriavtsev and Jose Juan Diaz Lopez.

**Optical and electrical properties of TiO2-GO hybrid nanostructures by ball-milling**

**Abstract:** Mechanosynthesis, particularly through high-energy ball milling, offers a potent method for the fabrication of nanohybrids. This study explores the characterization of TiO2 and graphene oxide (GO) nanohybrids, focusing on their optical and electrical properties, as well as their photocatalytic performance. Optical measurements showed a reduction in the bandgap from ≈3.27 eV in pristine TiO2 to ≈3.02 eV in milled TiO2, while electrical conductivity increased from 5.59x10-9 to 2.48x10-8 S/cm. Despite these improvements, the addition of GO did not significantly impact the bandgap or electrical properties of the nanohybrids. Photocatalytic experiments using methylene blue (MB) under visible light irradiation demonstrated a dye degradation of ≈30-32% in all hybrid samples, indicating consistent photocatalytic activity regardless of GO oxidation degrees.

**ID68**

Gerardo Hernández, Alejandro Rodríguez, Máximo Sánchez and Mario Villafuerte.

**Forward-Forward Algorithm on Morphological-Linear Neural Networks**

**Abstract:** This paper proposes using the Forward-Forward (FF) algorithm to train hybrid neural networks. We implement the FF algorithm in Morphological-Linear Neural Networks (MLNNs), which consist of two layers. The first layer is made up of morphological neurons and the second consists of perceptrontype neurons. For this we adapt the FF training algorithm in the calculation of the goodness and loss functions derived from the morphological neuron layer. The calculation of the goodness and the loss functions was not modified for the perceptrontype neuron layer. The experimental results show that it is possible to train morphological-linear neural networks with the FF algorithm, obtaining results similar to those obtained with the original FF algorithm. The comparison between the original training algorithm and the proposed one is carried out with lowdimensionality and binary classification datasets from the IMDB natural language processing dataset. Likewise, the ability of the FF algorithm is analyzed and compared in terms of its ability to disentangle patterns for classification tasks.

**ID69**

José Desiderio Torres Rodríguez, Blanca Tovar Corona and Álvaro Anzueto Rios.

**Normal and Abnormal Lung Sound Classification for An Embedded System Implementation**

**Abstract:** Breath sounds serve as critical indicators of respiratory health, reflecting air movement, changes in lung tissue, and secretions within the tracheobronchial tree. While auscultation is a common clinical practice for detecting abnormal respiratory sounds, it is inherently subjective and prone to errors. This paper presents a novel methodology for processing respiratory sounds using frequency analysis based on Fourier transform and power spectral density (PSD) with Welch method. It introduces three multilayer perceptron (MLP) architectures designed for the automatic classification of lung sounds into normal and abnormal categories. The proposed approach analyzes 4-second respiratory cycles, employing different window sizes to limit the frequency response output of the PSD method, aiming to reduce the complexity of MLP architectures while maintaining high accuracy. The models were trained and tested on two public datasets, ICBHI-2017 and HF_LUNG_V1, achieving accuracies of 100%, 95%, and 91% for MLP1, MLP2, and MLP3, respectively. These results confirm the effectiveness of this approach in automatically classifying normal and abnormal respiratory sounds using MLP architectures. Furthermore, due to their simplicity, future efforts will focus on deploying these systems on hardware platforms, contributing to the development of portable devices that assist medical staff in identifying abnormal lung sounds.

**ID70**

Oswaldo Emiliano Rufino-Arteaga and Oscar Alejandro Garcia-Perez.

**Structural Health Monitoring in the Assembly of the Torsion Box and the Semi-wings**

**Abstract:** In this work the progression of damage is illustrated by reducing the preload in a bolted joint and subsequently losing one or more joints in a prototype of the assembly between the main beam of a semi-wing with the torsion box of

an airplane using the Natural Frequencies Vector Assurance Criterion (NFVAC) and the Damage Natural Frequencies Vector Assurance Criterion (DNFVAC) supported by experimental tests applying Experimental Modal Analysis (EMA) and simulation by means of the Finite Element Method (FEM) for applications in Structural Health Monitoring (SHM).

**ID71**

José-Emmanuel Vázquez-Galán, Laura-Ivoone Garay-Jiménez, Blanca Tovar-Corona and Martín-Arturo Silva-Ramírez.

**Synthetic EEG Signal Generator of Morphologies Associated with Epileptogenic Events**

**Abstract:** Abstract—Electroencephalography (EEG) is crucial for understanding brain signals. This work presents a methodology for synthetic EEG signal generation to simulate frequency bands, incorporate noise, and emulate specific phenomena. A Python-based tool allows controlled signal generation and export in various formats, and features a visualizer for analyzing user-uploaded signals in TXT, CSV, or EDF formats. EEGLAB evaluation confirms the accuracy and consistency of the generated signals. The tool supports research, diagnosis, and data analysis models requiring large datasets, particularly in neurological diseases like epilepsy. Pending web hosting, the tool will enhance accessibility and usability for broader applications.

**ID72**

Ramon Ulises Almada Prieto, Gilberto Enrico Vazquez Alcaraz and Jose Cruz Nunez Perez.

**Graphical Interface for Obtaining Lyapunov Exponents in Fractional Order Chaotic Systems**

**Abstract:** In this article, a graphical user interface (GUI) is developed and designed in Matlab using the Guide tool, capable of solving and graphing fractional-order chaotic systems with 3 to 5 different variables, obtaining the system's Lyapunov exponents, as well as its bifurcation plot and equilibrium points. To achieve this, the numerical method based on the Adam-Bashforth-Moulton predictor-corrector is used to solve chaotic systems of the same or different fractional orders, as well as the Benettin-Wolf algorithm to obtain the Lyapunov exponents in fractional-order chaotic systems. Finally, the results of each of the simulations for two different fractional-order chaotic oscillators are presented: The Lorenz oscillator and the Chen oscillator. The importance of calculating the Lyapunov exponents and obtaining the bifurcation plot of a chaotic system lies in the fact that these results are a great indicator of whether the system has chaotic behavior with its current parameters or for a previously defined range of parameters. Similarly, it is important to know the equilibrium points of the chaotic system, as these values indicate the number of wrappings the system has, as well as being a clear indicator of the values towards which the system's oscillations tend.

**ID73**

Emmanuel de Jesus Gonzalez-Ramos, Luis Angel Olvera-Martinez, Manuel Cedillo-Hernandez, Carlos Adolfo Diaz-Rodriguez and Leonardo Faustino-Morales.

**Symmetric cipher for grayscale images based on quantum differential geometry**

**Abstract:** The increase in information technologies has generated the need to implement new methodologies to secure the exchange of information. This paper proposes a cryptographic algorithm based on the use of quantum differential geometry operators. These operators exhibit mathematical behaviors like quantum behavior, with the advantage that specialized equipment is not required to perform the encryption process. The algorithm is composed of two phases: In the first phase, a subkey is generated through an addition and multiplication process in Z_16 based on a user-defined key. In the second phase, three types of fundamental quantum operators are employed: creation, annihilation, and crossing, which are sequentially connected. The specific selection and configuration of these operators are based on their ability to avoid generating correlation between the data. The method proposed in this work is evaluated using the Peak Signal-to-Noise Ratio (PSNR), the Structural Similarity Index Measure (SSIM), and the Correlation Value, to measure the fidelity and integrity of the recovered images.

**ID74**

Erasmo Gabriel Martínez Soltero, Joshua Alexander Aguilar, Carlos Humberto Avila Sanchez and Alma Y. Alanis.

**Semantic Segmentation to Identify Enemies in First-Person Shooters**

**Abstract:** Video games are used as simulations in training for activities of real life, with that as a base, this work presents a comparative study between seven different architectures of convolutional neural networks that perform semantic segmentation. These networks are applied to segment individuals in first-person shooters, four of them aim to return a result as fast as possible and the other three are short versions of networks focused on the quality of the segmentation.

**ID75**

Citlalli Rodriguez, Cesar Camas, Dorian Valencia, Irving Zúñiga and Heber Vilchis.

**Multiscale Computational Roughness Analysis of InGaAs Growth Process for Solar Cell Applications**

**Abstract:** In this work, we analyzed the interactions between indium gallium arsenide (In-Ga-As) atoms via Molecular Dynamics (MD) for the growth of thin films through evaporation methods with applications in tandem solar cells. In addition, film roughness and its influence on device performance were determined using the Silvaco ATLAS software. To optimize the growth conditions, we used the MD method with the open-access code LAMMPS to reproduce the thermodynamic phenomena that occur during deposition. We built different models in agreement with the information found in repositories for the interatomic Tersoff potentials of As, Ga, and In. Subsequently, we obtained the film roughness at different stages of the process and performed an electrical stimulation of the tandem solar cell. As part of the results, we obtained long deposition interactions at different temperatures and density flux. In the electrical simulation using Silvaco Atlas, the rms (root-mean-square roughness) values of film growth for models 1 and 2 revealing that Model 2 achieved an efficiency of 19.84%, higher than the 16.79% efficiency of Model 1.

**ID76**

Oscar Eduardo Aguilar Mejía, Ernesto Suaste Gómez and José de Jesús Agustín Flores Cuautle.

**Development of novel lead-free ceramic electrodes for the acquisition of bioelectric potentials.**

**Abstract:** Recently, experiments were conducted with potassium niobate ($KNbO_3$) ceramics, a lead-free material that possesses ferroelectric and piezoelectric properties, among others, by incorporating a platinum implant within them to evaluate their effectiveness as devices for recording electrical potentials from the human body. Using the proposed instrumentation, which includes an isolated differential amplifier, and a lock-in amplifier, ECG, EMG, and EOG (eye movement recordings) were obtained. These recordings were compared with those obtained using conventional electrodes, showing similar results.

**ID79**

Maricela Meneses, Mario Francisco Ávila Meza, Juan Ramon Ramos Serrano, Yasuhiro Matsumoto, Manmohan Jain and Srinivas Godavarthi.

**White electroluminescence of SiOxCy films obtained by HW-CVD using vinyl silane**

**Abstract:** White electroluminescence (EL) at room temperature was observed using a metal-insulator-semiconductor (MIS) capacitor with the silicon oxicarbide (SiOxCy) film as an active layer. SiOxCy films were deposited by the HW-CVD system from vinyl silane precursor. The active film was thermally annealed at 450 °C in N2. Blue-red photoluminescence was observed from the as-deposited film, while the annealed film displayed blue-green emission. The emission was attributed to defects such as WOB, NOV, and NBOHCs. Fourier transform infrared spectroscopy showed an increase in Si-O bonds after the thermal annealing, which could contribute to the PL. White EL was observed at voltages greater than 25 V and a current density of 〖1×10〗 ^(-2) A⁄〖cm〗 ^2 on the entire device area. The EL and PL emission mechanisms at 409 nm were related to NOV defects. Based on EL and current–voltage measurements, space charge limited conduction (SCLC) was proposed as the charge transport mechanism. These results highlight that the SiOxCy obtained from vinyl silane is a promising candidate for the development of silicon-based white light-emitting devices.

**ID80**

Luis Elias Salgado Solano, Oliverio Arellano Cárdenas, Luis Martin Flores Nava and Felipe Gómez Castañeda.

**Bearing Failure Classification with Metaheuristic Adjust of the Extreme Learning Machine Model**

**Abstract:** In this study, we propose the use of an Extreme Learning Machine model with a metaheuristic adjust of parameters, to recognize mechanical vibration data from bearings, in order to determine whether the device is in good condition or experiencing some type of malfunction. Our approach involved designing a supervised Extreme Learning Machine model whose parameters are adjusted by a Grey Wolf approach. We employed a dataset from Case Western Reserve University, available on their website. In this database the signals were gathered by sampling an accelerometer at 12 kS/s, placed radially on a bearing. The data was collected for four scenarios: one with vibrational signals from a healthy bearing, and three with bearings having induced faults in the inner race, outer race, and ball, respectively. This intelligent system was developed using Python in the Spyder environment, integrated with Pytorch framework, obtaining promising results.

**ID81**

Juan Ramón Ramos-Serrano, Mario Moreno, Alfredo Morales, Armando Hernández, Victor Aca and Ignacio Juárez.

**DC and RF Sputtered ITO Thin Films as Electrodes in Light-emitting Diodes Based on a-Si1-xCx:H**

**Abstract:** The study of the optical and electrical properties of ITO thin films deposited by sputtering using DC and RF power supplies is reported in this work. Afterward, two light-emitting PP+IN diodes based on a-Si1-xCx:H were fabricated by the PECVD technique using ITO films deposited at 15 W in DC and 25 W in RF as transparent electrodes. The films were obtained by varying the deposition power at a substrate temperature of 170 °C. All films showed resistivity at close values (10-3 Ω·cm) for DC or RF deposition. On the other hand, the ITO films deposited by RF showed a higher transmittance and optical gap energy. This may be related to a higher oxygen deficiency in the DC films. X-ray diffraction measurements revealed an amorphous structure for the RF film and a polycrystalline/amorphous structure for the DC film. The J-V characteristic of the P+PIN diodes showed the same profile with a little shift related to the differences in the series resistance from the ITO electrodes. The electrical charge transport was related to Pool-Frenkel and trap-assisted tunneling mechanisms in both cases. Both diodes showed red-orange emission with spectra centered at 630 nm, however, the DC diode spectra showed a lower emission intensity.

**ID82**

Gabriela Barron, Maria de La Luz Olvera, Arturo Maldonado and Heberto Gomez Pozos.

**Structural, electrical and optical properties of ZnO films deposited by ultrasonic chemical spraying for application as transparent conductors**

**Abstract:** Zinc oxide (ZnO) thin films were fabricated using the ultrasonic chemical spray method. Several initial solutions were prepared using Zn precursors that were milled and others that were not and then deposited on glass substrates. The milling of the precursors was carried out using a planetary ball mill at 300 rpm for different times: 15, 30, 45, 60, and 120 minutes. The ZnO films were manufactured at a constant deposition temperature of 475°C and two different deposition times: 8 and 14 minutes. The results indicate that, under identical deposition conditions, the electrical properties of ZnO thin films fabricated from milled precursors are superior to those obtained from initial solutions prepared with unmilled precursors. X-ray diffraction analysis confirmed that all spectra of the films match well with the hexagonal wurtzite structure, exhibiting a preferential orientation along the (002) planes. Characterization of the surface morphology by scanning electron microscopy (SEM) revealed changes in morphology with the milling process. Therefore, the use of milled precursors for the deposition of ZnO thin films by ultrasonic chemical spraying has a significant impact on their physical properties.

**ID84**

Abqa Javed, Sahar Ajmal, Taliah Tajammal, Muhammad Aslam, Ana Maria Martinez-Enriquez and Usman Sadiq Sheikh.

**Enhancing Anxiety Prediction: Leveraging Machine Learning with Functional Design Metrics**

**Abstract:** Fear, nervousness, and social phobia all contribute to anxiety episodes reaching their peak in seconds. Using data collected from patient questionnaires, this study seeks to anticipate and diagnose anxiety disorders effectively and precisely using machine learning techniques. However, current research offers standardized metrics for assessing machine learning models throughout the design process. This work presents a systematic method for efficiently

extracting literature from digital sources and emphasizes the need for data engineers to evaluate machine learning models' efficiency to assure forecast quality. The International Organization for Standardization (ISO) 9126 standard is used to assess machine learning models for anxiety prediction to address this gap. This evaluation considers parameters such as functionality, accuracy, resilience, throughput, explainability, privacy, and correctness. These defined characteristics serve as the benchmark to measure the efficacy of machine learning models in predicting anxiety disorders.

**ID90**

Tarek Berghout.

**Anemia Severity Detection in Pediatric Patients through REXlayer-Integrated Deep Learning and Eye Conjunctival Imaging**

**Abstract:** Anemia, particularly among young children, poses significant health risks and necessitates timely and accurate diagnosis for effective management. Traditional diagnostic methods for anemia are often intrusive and distressing, especially for pediatric patients. This study introduces a Recurrent Expansion Layer (REXlayer), a novel representation learning layer designed to learn both independent-dependent variables' relationship in pretrained neural networks. This enables exploration and understanding of multiple learners to derive better conclusions about data behavior. In this work, REXlayer is integrated with a single-layer Long Short-Term Memory (LSTM) network for the precise detection of anemia severity (i.e., non-anemic, mild, moderate, severe) using non-intrusive eye conjunctival images of young children. The proposed method involves a sophisticated preprocessing pipeline that enhances the quality and relevance of input image data. This preprocessing pipeline includes image segmentation, feature extraction, scaling, feature selection, and class balancing, ensuring robust input features for the learning model. The REXlayer, integrated within LSTM framework, effectively processes these preprocessed images to predict anemia severity levels. Experimental results of REX-LSTM model, compared to ordinary LSTM, demonstrate the efficacy of REXlayer-enhanced model, showing improved accuracy and reliability in anemia detection. This approach not only advances the field of pediatric anemia diagnosis but also underscores the potential of integrating advanced preprocessing techniques with innovative deep learning layers for medical image analysis, offering a less invasive alternative for young patients.

**ID92**

Alfredo Morales Sánchez, José Juan Avilés Bravo, Braulio Palacios Márquez, Karim Monfil Leyva, Mario Moreno Moreno and Luis Hernandez Martínez.

**Effect of the Thermal Annealing Temperature on the Composition and Luminescent Properties of Silicon Rich-Nitride (SRN) and -Oxide (SRO) Films**

**Abstract:** In this work, a study of the optical properties of silicon rich oxide (SRO) and silicon rich nitride (SRN) films deposited by low-pressure chemical vapor deposition (LPCVD) is presented. Silicon excess in SRO and SRN was obtained by changing the flow ratio between N2O/SiH4 and NH3/SiH4, respectively. The effect of the annealing temperature on both Si-rich dielectric films was studied. Infrared spectroscopy showed microstructural changes within the SRO and SRN films after thermal annealing. Transmittance measurements exhibit variations in the bandgap of SRN and SRO by changing the silicon excess. Maximum luminescence intensity was observed in as-deposited SRN films while SRO films needs to be annealed at 1150°C. Therefore, SRN films are a potential candidate for optoelectronic devices.

**ID93**

Shoma Khanom, Mohammad Sakib, Nm Chisty, Munira Akter Mimi, Md. Ahad and Feroz Ahmed.

**Detection of Leg Tremors in Parkinson's Disease Patients: An Experimental Wearable Leg Band Solution**

**Abstract:** Parkinson's disease (PD) is a gradually worsening disorder of the nervous system that affects a person's ability to control their movements. As the disease gets worse, it makes it harder to move normally. Key symptoms include tremors at various stages. The usefulness of tremor characteristics for PD early identification and monitoring is examined in this study. Data from wearable sensors on (n=14) PD patients and normal volunteers, recorded during activities averaging 200±15 minutes, was used. A sliding window and segmentation technique were used to extract time-domain and frequency-domain characteristics. Machine learning models like K-Nearest Neighbour (KNN), Neural Networks (NN),

Discriminant Analysis (DA), Decision Trees (DT), Support Vector Machine (SVM), and Naïve Bayes (NB) were employed to identify distinguishing characteristics of Parkinson's disease (PD) patients compared to healthy controls. Validation was conducted using a leave-one-subject-out (LOSO) approach. The Linear Discriminant model had the lowest accuracy at 89.5% and the greatest F1 score of 90.4%, while the Fine K-NN model achieved the highest accuracy of 98.3% and an F1 score of 98.9%. These findings show how these ML techniques may be used to detect tremors in PD patients.

**ID96**

Mohammad Sakib, Hanif Mia, Mukta Akter, Jannatul Farduse, Sharmin Akter and Md. Shahjalal.

**Rainfall Prediction and Real-Time Weather Monitoring in Bangladesh: A Comparative Analysis of Machine Learning Algorithms**

**Abstract:** Recent advancements in technology, such as cloud computing, cyber-physical systems, and the Internet of Things (IoT), have significantly enhanced the capacity for efficient handling and transfer of large volumes of environmental data. Accurate rainfall prediction and weather monitoring have become increasingly complex due to climate change and variability. This study leverages various classification algorithms—Linear Regression (LR), Decision Tree (DT), K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and Naive Bayes (NB)—for rainfall prediction, alongside multiple sensors for real-time weather monitoring. The monitored parameters include temperature, humidity, rainfall, barometric pressure, carbon monoxide (CO) levels, air quality, dust concentration, ultraviolet radiation (UV), and geographic location, with data managed via the ThingSpeak cloud platform. Utilizing a dataset from the Bangladesh Meteorological Department (BMD), spanning from 1970 to 2016, the study evaluates the performance of these classification algorithms based on precision, recall, F1-score, and accuracy. The DT algorithm achieved the highest accuracy at 0.8688 and F1-score 0.9226, while the SVM algorithm recorded the lowest accuracy at 0.5381 and F1-score 0.6705. Notably, all models exhibited higher F1 scores relative to their accuracy metrics. This integrated weather monitoring and rainfall prediction system offers valuable potential for accurate environmental assessments in related projects.

**ID97**

Mohammad Sakib, Sadikul Hasan Mridha Atul, Tania Sarkar, Hanif Mia, A.S.M. Daiyan Haider Nafiu and Md. Shahjalal.

**Monitoring Toxic Gases in Dhaka Brick Kiln Areas & Comparing CNN vs. ResNeT for Brick Kiln Identification via Satellite Imagery in Bangladesh**

**Abstract:** In developing nations like Bangladesh, clay bricks are essential for construction, but the firing process generates exhaust and toxic gases that degrade air quality and harm local flora and fauna. Ensuring compliance with environmental regulations is crucial for clean environments and public health. In South Asia, small-scale, informal brick producers are significant polluters, making monitoring and regulation challenging. This study presents a cost-effective, scalable method for identifying brick kilns using high-resolution satellite imagery from Bangladesh, sourced from the Kaggle database. Utilizing convolutional neural networks (CNN) and Residual Neural Networks (ResNet) deep learning models on 6,147 satellite images, the approach achieves 100% accuracy and precision in identifying chimney kilns. Additionally, the research employs an Internet of Things (IoT)-based system with Arduino Uno, NodeMCU ESP8266, and MQ-7, MQ-8, and MQ-136 sensors to detect Carbon Monoxide (CO), Hydrogen (H2), and Sulfur Dioxide ($SO_2$). Experimental results show significantly higher sensor readings in polluted conditions: MQ-7 (clean air: 60.0650 ppm, polluted air: 500.0423 ppm), MQ-8 (clean air: 20.5425 ppm, polluted air: 150.6263 ppm), and MQ-136 (clean air: 70.1921 ppm, polluted air: 200.0489 ppm).

**ID99**

Hichem Ferhati, Fayçal Djeffal and Tarek Berghout.

**Steep Subthreshold Swing Nanoscale Tunnel FET based on Silicon Tin Channel and High-k Dielectric Gate**

**Abstract:** In this paper, we introduce an innovative design approach centered on optimized source/channel/drain structure using Silicon-Tin (SiSn) binary alloys to enhance the Subthreshold Swing (SS) factor of nanoscale ultra-thin film Double Gate (DG) Tunnel-FET design. In this context, accurate numerical models taking into account tunneling effects and quantum transport are developed. The influence of the Sn mole fraction on the device's switching characteristics

and resulting current capability is thoroughly examined. Additionally, the influence of high-k dielectric materials on device performance is analyzed. The optimized SiSn DG TFET device demonstrates a very low Subthreshold Swing factor of 25.5 mV/dec, while maintaining a reduced ambipolar behavior. Therefore, the proposed design framework strategy paves not only to identify the appropriate binary alloys associated with the optimized mole fraction values, but also to develop efficient ultra-low power multigate transistors

**ID100**

Amandine Azzarello, Antoine Eon, José Gabriel Ramírez Torres and Jean-Pierre Gazeau.

**Mobile Manipulation Based on ROS1/ROS2 Middleware: Software Architecture and Evaluation of ROS2 Planning Algorithms**

**Abstract:** Developing an application based on ROS (Robot Operating System) requires considering several features to achieve a scalable, robust, and stable software architecture. This paper presents our chosen software architecture for autonomous mobile manipulation, addressing the need to manage inter-component communication involving both ROS1 and ROS2 versions of the middleware. Based on this architecture, selecting SLAM and ROS2 planning algorithms remains a complex issue, particularly for industrial environment navigation. In this context, we propose and discuss an evaluation of ROS2 planning algorithms based on specific criteria. This document presents the advancements of our research work, as part of a doctoral thesis, on the development of a software architecture for autonomous object manipulation in an industrial environment using mobile manipulator robots.

**ID101**

Mauro Alberto Lopez, Richard Torrealba, Cesar Augusto Arriaga and Edna Iliana Tamariz.

**IoT-Based USV for Water Quality Monitoring**

**Abstract:** This paper presents the design and implementation of an Unmanned Surface Vehicle (USV) equipped with sensors for monitoring water quality in a lagoon. Utilizing the Internet of Things (IoT), the USV was connected to a Graphical User Interface (GUI) allowing for real-time control and visualization of the sampled parameters. The GUI also facilitated data storage, creating a cloud-hosted database. Consequently, graphical representations were generated to compare the behavior of each parameter over a three-day period, providing valuable insights into the water's condition.

**ID102**

Diego Hernán Gaytán Rivas, Jorge Rivera Domínguez, Susana Ortega Cisneros, Héctor Emmanuel Muñoz Zapata and Emilio Isaac Baungarten Leon.

**On the Novel Design and FPGA Implementation of a Fuzzy PD Control for a DC Motor**

**Abstract:** In this work, a parametrizable, standardized, and modular architecture design for the implementation of a Mamdani-like fuzzy controller for a DC motor is presented. The proposed architecture permits making modifications to the implemented controller in a simpler fashion. In order to avoid noise problems with the time derivative of signals, a robust sliding mode differentiator was used. This differentiator has been proven to be more effective than classic differentiators. Real time results showed its effectiveness and good performance by successfully tracking a step-wise, and sinusoidal reference signals, obtaining errors of less than 2% in steady state.

**ID104**

Ada Michelle Velazquez Flores, José Abraham Morales Jimenez, Cristina Elizabeth Reyes Soto, Rigoberto Martinez Mendez, Zeus Tlaltecutli Dominguez Vega and Otniel Portillo Rodríguez.

**Effect of Foot Position on Postural Balance Assessment Using Center of Pressure Parameters During the Romberg Test**

**Abstract:** The Romberg test is widely used for static postural balance assessment, but the effect of foot position on center of pressure (CoP) parameters remains unclear. This study compared CoP parameters in 47 participants aged 13 to 71 years, with two foot positions: a comfortable stance and feet together. This broad age range was used to capture significant diversity in physical development, balance, and health conditions, ensuring results representative of

variability in a general population. Participants performed the test with eyes open (EO) and closed (EC). CoP parameters such as mean velocity, range, standard deviation, area of the 95% confidence ellipse, mean frequency, and Romberg ratio were measured. Paired t-tests were used to evaluate the effect of vision and foot position. The results showed that both vision and foot position significantly influenced postural stability, with greater sway in the EC and feet together conditions, especially in the mediolateral direction. For example, mean velocity increased from 10.02 ± 4.09 mm/s in EO-comfortable stance to 21.75 ± 8.93 mm/s in EC-feet together. These findings highlight the importance of standardizing foot position and considering the effect of vision when assessing postural stability.

**ID105**

Emmanuel Gamero Ramirez, Jorge Antonio Torres Muñoz and Jesús Norberto Guerrero Tavares.

**Adaptive Gains Sliding Mode Observer for the Estimation of Unknown Dynamics in a Heavy Metal Bioremediation Process**

**Abstract:** Water contamination by heavy metals from industrial sources affects public health and harms flora and fauna. Bioreactors using microalgae can remove these metals, but their sensors are often expensive and invasive. To address this, observation algorithms based on sliding modes are proposed to estimate unknown parameters and external disturbances, like changes in the dilution factor due to input regulation issues. Adaptive gains were added to these algorithms. The study evaluates and compares their performance to analyze their advantages and disadvantages.

**ID106**

Mayra Adriana León-Sánchez, Yazmín Mariela Hernández-Rodríguez, Oscar Eduardo Cigarroa-Mayorga and Rafael Bayareh-Mancilla.

**Comparative Analysis of CLAHE and VOI LUT for Enhanced Mammogram Contrast in Tumor Detection**

**Abstract:** This study presents a comparative analysis of Contrast Limited Adaptive Histogram Equalization (CLAHE) and Value of Interest Look-Up Table (VOI LUT) as preprocessing methods for enhancing mammogram contrast to improve tumor detection. Using a dataset of 928 mammograms (464 BI-RADS 1 and 464 BI-RADS 4 and 5), we evaluated the performance of these methods in detecting tumors by extracting texture features using the Gray-Level Co-occurrence Matrix (GLCM) and classifying them with a Support Vector Machine (SVM). The results indicate that CLAHE slightly outperforms VOI LUT, with classification metrics showing precision, recall, F1-score, and accuracy of 0.57 for CLAHE compared to 0.55 for VOI LUT. These findings suggest that CLAHE may be more effective in enhancing mammogram textures, thereby improving the detection and classification of breast tumors. Future work should explore additional preprocessing techniques and classification algorithms to further validate and improve these results.

**ID107**

Israel Iván Lara Garcilazo, Juan Jesús Rocha Cuervo, Venkata Krishna Karthik Tangirala and Angélica Guadalupe Hernández Zanabria.

**Green Synthesis of ZnO and $SnO_2$: structural and morphological studies based on citrus extracts**

**Abstract:** ZnO and $SnO_2$ nanoparticles were synthesized using orange (Citrus sinensis) and lemon (Citrus latifolia) peel extracts via homogeneous precipitation. Fourier-transform infrared (FTIR) confirmed the presence of metallic bonds, while Raman spectroscopy highlighted structural disorder due to organic residue interference. X-ray diffraction (XRD) indicated that ZnO nanoparticles formed a hexagonal wurtzite structure, while $SnO_2$ displayed a tetragonal rutile phase. SEM and DLS results showed that ZnO and $SnO_2$ nanoparticles varied significantly in size and morphology depending on the extract used. Nanoparticles synthesized with lemon extract were larger and more agglomerated, due to the high acidity of the extract, which affected its stability. In contrast, orange extract produced smaller and more uniform nanoparticles, particularly in the $SnO_2$ samples, making them more suitable for photocatalytic applications. This study highlights the impact of pH and metabolites on green synthesis and suggests that process optimization can improve the quality of nanomaterials.

**ID108**

Alfonso Caleb Vázquez Ruiz, Yael Magaña Aguilar, Fernando Almendra Cruz and Venkata Krishna Karthik Tangilara.

**Effect of Al doping on SnO2 nanoparticles for CO sensing**

**Abstract:** In this present work, pure and Al doped (1, 2 and 4 wt%) SnO2 nanostructures were obtained using homogeneous precipitation, where NaOH is utilized as precipitation agent. Also, subsequent thin films sensors were fabricated using drop casting method. All sensors fabricated were tested in different CO atmospheres for evaluating their sensing properties. Vibrational modes and particles size were obtained by Dynamic light scattering and Fourier Transform Infrared (FTIR) spectroscopy techniques respectively. Incorporation of dopant resulted in uniform particle size and Sn-O binding energy reduced confirming the incorporation of Al into the SnO2 lattice. Also X-Ray diffraction justifies the FTIR results. Morphological analysis by Scanning Electron Microscope confirms the formation of spherical micro and nanostructures and the particle size increased with respect to doping percentage. Finally, the gas sensing responses around 97% were recorded when sensors were operated at 300 0C.

**ID109**

Rabia Ouchen, Tarek Berghout, Fayçal Djeffal and Hichem Ferhati.

**Subthreshold Swing Performance Assessment of Nanoscale Junctionless GAA FETs using Machine Learning Approach**

**Abstract:** In this work, the current–voltage (I–V) characteristics of nanoscale Junctionless Gate-All-Around (JLGAA) Field-Effect Transistor (FET) structures, with and without high-k dielectric materials, were investigated using the ATLAS 2D simulator. Various machine learning (ML) algorithms were employed to analyze and classify the design factors influencing one of the principal electrical parameters of the device, whixh is the subthreshold swing (SS) factor. The SS factor is a critical parameter in evaluating the performance of nanscale Junctionless GAA FETs, quantifying how effectively
the transistor can switch from the off state (low current) to the on state (high current). Our approach aims to study and classify the impact of oxide thickness, channel radius, channe doping and high-k dielectric materials to better understund and enhance the gate control and achieve optimal performance. It was found that the proposed design can be classified into three categories based on SS values: Good SS (< 80 mV/decade), Worst SS (80-500 mV/decade), and Extermly Worst-case SS (> 500 mV/dec). This classification of SS values in 20 nm-Junctionless GAA FET provides a framework for understanding the trade-offs between performances and design parameters.

**ID112**

Oscar Federico Garcia-Castro, Luis Enrique Ramos-Velasco, Vicente Parra-Vega, Rodolfo Garcia-Rodriguez and Carlos Ernesto Vazquez-Garcia.

**Neural Network Modeling of Continuum soft robots based on WaveNets Equipped with Adaptive IIR**

**Abstract:** Soft robots have attracted attention from many areas, such as robotics, materials, automatic control, and artificial intelligence. The particular class of continuum soft robot (cSR) is the most challenging given its highly nonlinear dynamics from the hyperviscoelasticity and varying stiffness, which arise from the modeling of an infinite conglomerate of particles enclosed in a deformable finite-dimensional body based on the lumped parameters assumption and the D'Alambert principle. The cSR is a complex model, presenting a significant challenge in the field. Its non-intuitive structure, variable natural frequency, and parametric uncertainties, including its input matrix and lack of reliable velocity measurements, make it difficult to approximate its dynamics using only input and partial output data. This paper proposes a wavelet-based neural network (WaveNet) with an adaptive infinite impulse response (IIR) output filter. The WaveNet sweeps over modal frequencies, while the IIR enforces feedback and forward loops to propagate current and past neural outputs. The input shapes a controllable canonical output form. Simulations for a 2 degree-of-freedom cSR show that a bounded approximate modeling error is guaranteed at a low computational cost.

**ID113**

Jesús Jiménez-León, Arturo Sarmiento-Reyes and Pedro Rosales-Quintero.

**Novel Modeling Methodology for Memristive Devices for Circuit Design and Simulation**

**Abstract:** This work introduces a methodology for obtaining the high-level model of memristive devices. The methodology uses the I-V curve points of the device. Model equations are derived from the calculation of a state-variable

of a first-order differential equation that describes the dynamics of the device. As a demostration, the procedure has been applied to three classical memristor models from which new modeling equations have been developed. Comparison between the resulting model and the initial data points is carried out by measuring the Mean Absolute Percentage Error (MAPE), resulting in 4%, 2.8% and 20.1% when compared to original Strukov's, Biolek's and Chang's models, respectively. This methodology simplifies the simulation process by maintaining a first-order state variable for the model, and avoiding highly non-linear equations such as those introduced by window funcions in the port equation.

**ID114**

Maria Laura Miranda Leon, Jesús Carlos Pedraza Ortega, Marco Antonio Aceves Fernandez and Juan Manuel Ramos Arreguin.

**A Comparative Analysis of Object Detection Models for Drowsiness Detection: Evaluating Raw, Processed, and Hybrid Image Datasets with Faster R-CNN**

**Abstract:** In Mexico, last year, 5.10% of accidents attributed to human factors were related to drowsiness. Consequently, this study investigates the detection of objects to identify visible signs of drowsiness, such as the eyes and mouth, employing a Faster R-CNN model with ResNet50 and FPN. A comparative analysis is conducted using three datasets: raw images, processed images, and a hybrid set comprising both. The results indicate that although the model trained on raw images exhibited the lowest loss and superior performance for certain classes, the model trained on processed images demonstrated the highest efficiency in training time. Meanwhile, the model trained on the hybrid set achieved a balanced performance, integrating the strengths of both preceding models.

**ID115**

Michelle Guerra Marín, María Aurora Diozcora Vargas Treviño, Sergio Vergara Limón, Jesús López Gómez, C. Leopoldo Carreon Diaz de Leon and Daniel Marcelo Gonzalez Arriaga.

**A Convolutional Neural Network-based Parametric Identification for the Dynamic Model of a Cartesian Robot in a FPGA Framework**

**Abstract:** Parametric identification in robotic systems involves determining key parameters within a system's model to enhance performance. This paper presents a novel convolutional neural network (CNN) architecture designed for a parametric identification of four parameters in the dynamic model of a Cartesian robot with three degrees of freedom, which it was designed by the authors of this paper. The dynamic model is derived by the lumped parameter methodology using the Euler-Lagrange equations of motion. Detailed explanations of the neural network's configuration and training methodology are provided, aiming to maximize its effectiveness in real-world applications, thereby improving overall performance and robustness. The results show that the parametric identification of the CNC robot achieves a similarity percentage of approximately 85 \% with the experimental data.

**ID116**

Juan Francisco Pintor Michimani, María Aurora Diozcora Vargas Treviño, Sergio Vergara Limon, Jesús López Gómez, Margarita Carmina García Gómez and Luis Arturo Alcantar Vergara.

**Design and Implementation of a Probe for 3D Scanning with FPGA-Based Architecture**

**Abstract:** This work presents the design of a probe, which is a tool that is installed in a Cartesian CNC robot of 3 degrees of freedom (GDL). The probe was designed to perform high-resolution scanning of parts. In order to study the behavior of the mechanism, the dynamic model of the robot is presented, by means of the methodology of lumped parameters using the Euler-Lagrange equation. On the basis of this study, a control system for the robot is developed using an embedded system in a Cyclone V FPGA (Field Programmable Gate Array) from Altera, which allows the position of each motor to be controlled.

**ID118**

Ashok Adhikari, Dwight Roberto Acosta-Najarro, Amira Jalil Fragoso-Medina, Tommy Kevin Merino Alama, Odin Reyes Vallejo, Francisco Javier Cano and María de La Luz Olvera Amador.

**An Application of Vanadium Oxide Thin Film as Window Layer in CIGSe Thin Film Solar Cells: A Computational Study**

**Abstract:** In this simulation study, the SCAPS software is used to analyze the Cu(In, Ga)Se2 (CIGSe) thin film solar cells. The parameters, such as thickness, bandgap, and carrier concentration of CIGSe absorber layer, V2O5 buffer window layer and ZnO window layer are investigated to obtain the best device performance. The efficiency of CIGSe thin film solar cells is slightly enhanced by absorbing more photons when the CIGSe thickness increases from 1 to 6µm. The variation of CIGSe bandgap affects all four solar cell parameters, which is directly related to the energy of incident photons. The open circuit voltage and fill factor are dependent on the CIGSe carrier concentration. The optimum values of 3 µm, 1.4 eV, and 1016 cm-3 were thickness, bandgap, and carrier concentrations for CIGSe. A very thick layer of window layers can raise the series resistance and a very thin layer can reduce the shunt resistance of the device. Both of these conditions strongly decreased the fill factor and consecutively the efficiency value. The best thicknesses of 100 and 25 nm were observed for V2O5 and ZnO materials, respectively. The carrier concentrations for the window layer must be higher compared to the absorber layer for improving the device's performance. The optimum efficiency of 14.58 % is found for CIGSe thin film solar cells after using the best parameters of CIGSe, V2O5, and ZnO. Hence, the SCAPS software is promising for modeling and is imperative to assess the proposed physical structure's practicability and performance.

**ID119**

Pablo De Villeros, Juan Diego Sánchez-Torres, Michael Defoort and Alexander Loukianov.

**Fully Distributed Federated Learning Using a Zero-Gradient-Sum Algorithm**

**Abstract:** This paper investigates a distributed method for solving the problems of regression and binary classification in the scope of the Zero-Gradient-Sum (ZGS) theory without local minimization. Instead of a unique model for the whole dataset, the proposed algorithm uses an ensemble of smaller models for the dataset samples, modeled as leaderless coordinated agents over a dynamic network. This algorithm relies only on local information and, in contrast to many algorithms in current literature, agents are not required to share the gradients of the local cost function or raw data, which is a convenient characteristic when privacy is a significant concern. The presented learning algorithm uses a finite-time sliding mode controller to reach the ZGS manifold as the system evolves exponentially toward the global optimum. Numerical simulations are conducted to illustrate the effectiveness of the algorithm.

**ID120**

Zareen Tasnim Pear and Hafsa Binte Kibria.

**Enhanced Network Intrusion Detection Using a Hybrid CNN-LSTM Approach on the UNSW-NB15 Dataset**

**Abstract:** In the era of rapid technological advancements, data and information have become significant assets that require continuous protection from unauthorized access and malicious attacks. Network Intrusion Detection Systems (NIDS) can effectively manage the increasing data demands assuring robust security. However, traditional or manual methods are often inadequate to cope with the sophisticated and evolving nature of cyber threats due to their inability to quickly process large volumes of data. Traditional machine learning models are widely used for this purpose. Recently deep learning approaches have become popular in classification tasks showing promising results. This paper introduces a hybrid deep-learning approach for detecting various network intrusions using binary and multi-class (ten classes) classification on the well-known UNSW-NB15 dataset. The proposed hybrid CNN-LSTM model demonstrates significant improvements in intrusion detection, achieving an accuracy of 97.19% for binary classification and 87.70% for multi-class classification, particularly in handling complex attack patterns and reducing false positives. Evaluated using metrics such as precision, recall and F1-score, the model consistently performs robustly across nine distinct attack categories. These results highlight the model's effectiveness in establishing enhanced network security.

**ID124**

Uriel Pérez Flores, Amparo Dora Palomino Merino, Jesús Ricardo López Gutiérrez and Sergio Vergara Limon.

**Modeling and Control of Ankle Exoskeleton**

**Abstract:** This article presents the development of an exoskeleton designed to assist ankle flexion and extension in patients with reduced mobility, such as those with foot drop. The device is oriented towards passive rehabilitation

exercises, for which a dynamic model of the exoskeleton is obtained using position and angular velocity sensors, considering the natural biomechanics of the limb and the degrees of freedom associated with its physiology. The implementation of a Proportional Derivative (PD) control with an additional term allows the ankle movement to be controlled precisely. Likewise, an inertial sensor is integrated that classifies the phases of gait by measuring the inclination of the foot with respect to the ground, generating precise commands to control the ankle movement. The simulation results suggest that the exoskeleton has a high potential to improve assistance processes, correctly following the defined trajectories and adapting to the different phases of movement, which facilitates a more efficient recovery in patients.

**ID125**

Kevin Rueda Castellanos, Brenda Garcia Farrera, Maria de La Luz Olvera Amador and Venkata Krishna Karthik Tangirala.

**CO Gas Sensing Properties of Zn2SnO4 Thinfilms.**

**Abstract:** This study investigates the structural, morphological, and gas-sensing properties of four samples: $SnO_2$-R.T., $SnO_2$-500ºC, $Zn_2SnO_4$-R.T., and $Zn_2SnO_4$-500ºC. The samples were synthesized via magnetron-assisted physical vapor deposition (PVD-RMS) and characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The XRD analysis revealed that $SnO_2$-R.T. likely has an amorphous nature, preventing the detection of characteristic peaks, while the other samples exhibited crystalline structures. FTIR spectra confirmed the presence of Sn-O-Sn and Zn-O-Sn bonds, indicating successful incorporation of zinc into the $SnO_2$ matrix, forming zinc stannate ($Zn_2SnO_4$). SEM images showed that the $Zn_2SnO_4$ samples had increased roughness and porosity compared to $SnO_2$, with thin film thicknesses ranging from 300-350 nm for $SnO_2$ and 450-500 nm for $Zn_2SnO_4$. These structural differences were attributed to thermal treatments and calcination processes, which influenced particle size, distribution, and agglomeration. Gas sensing tests were conducted for CO concentrations of 50, 100, and 166 ppm. The results suggest that the $Zn_2SnO_4$ samples, particularly $Zn_2SnO_4$-500ºC, demonstrated promising sensitivity and selectivity for CO detection, attributed to their homogeneous distribution, rough surface, and smaller particle size. This study underscores the potential of $Zn_2SnO_4$ for gas sensing applications, particularly in detecting CO at low concentrations.

**ID126**

Héctor Gerardo Martínez Fuentes, Mario Ibrahin Gutierrez, Jorge Airy Mercado Gutierrez and Josefina Gutiérrez Martínez.

**Exploring Reproducibility of fMRI Analysis Using SPM and Nilearn Open-Source Tool**

**Abstract:** Functional magnetic resonance imaging (fMRI) is a widely used technique for studying human brain activity. Various libraries and tools are available for performing the analysis and preprocessing of data. However, a significant challenge is that these different tools often yield varying results, which can complicate the interpretation and comparison of studies. In this context to contribute to the transparency of the used framework and reproducibility of the results in fMRI studies, this work presents a comparative analysis using Nilearn, a library available for Python, and SPM, a graphical interface available in MATLAB, along with preprocessing conducted with SPM in Nipype, also available for Python. Blood oxygen level-dependent (BOLD) contrast and anatomical volumes from one subject of the Flanker Task dataset were used. For this purpose, three distinct contrasts were established: Congruent > Incongruent, Congruent > Baseline, and Incongruent > Baseline. A point-by-point comparison of these masks was performed using a density plot and visualization of the different masks in the subject's anatomical volume. The results indicated that the design matrices of SPM and Nilearn are slightly different despite being configured with the same parameters, leading to significant differences in the final results.

**ID127**

Luz Margarita Balcazar Villatoro, Arturo Maldonado Alvarez and Maria De La Luz Olvera Amador.

**Transparent and conductive Al-doped ZnO thin films. Influence of Al concentration**

**Abstract:** Aluminum doped zinc oxide films, AZO, deposited onto soda-lime glass substrates by the ultrasonic spray pyrolysis, USP. The molar concentration of the starting solution, temperature and time deposition were kept constant at 0.2M, 450°C and 6.5min, respectively. The Al concentrations in the starting solutions were varied at values of 1, 2, 3

and 5 at%. In this work, the structural, morphological, optical and electrical properties of AZO thin films were analyzed by using X-ray diffraction, XRD, scanning electron microscopy (SEM), UV-Vis spectroscopy and sheet resistance and Hall effect measurements, respectively. In all samples, the preferential growth in the [002] direction was observed. The average optical transmission in the UV-Vis region of AZO films presented higher transparencies than 80%. The energy bandgap values varied around of 3.3eV. Deposited AZO thin films resulted conductive and transparent with a maximum figure of merit of 1.86x10-3 (Ω/□)-1, that make them applicable as transparent electrodes.

**ID129**

Omar Sandre Hernandez, Jesus Patricio Ordaz Oliver, Roberto Morales and Enrique Hernández Rodríguez.

**A Cascade Constrained MPC scheme for the Speed and Current Control of an Induction Motor Drive**

**Abstract:** This paper introduces the design of a constrained model predictive control (MPC) scheme for the speed and current control of an induction motor (IM) drive. In the control scheme, an inner MPC controller is used to regulate the d-q currents; while an outer loop is used to regulate the speed of the IM. The cascade MPC scheme is formulated as a constrained optimization problem to fulfill the operational limits for the current and voltage of the IM. Simulation results on Matlab/Simulink are presented to validate the proposed control scheme.

**ID130**

Nazhir Amaya-Tejera, Eduardo Zurek and Matías Alvarado.

**Emotion Regulation in Breast Cancer Patients: Initial study with Regression Models**

**Abstract:** Positive emotion regulation is perceived that contribute to improving the health of patients diagnosed with cancer. To our best knowledge, there are no systematic studies that conclusively support this perception. Existing research analyzes just negative emotions and their impact on health. We intend an initial development of linear regression method, Support Vector Machine (SVM) and Random Forest Regression algorithm (RFR) for running computational simulations to predict scenarios on the quantifying impact of positive emotion management, regarding the immune response of patients diagnosed with breast cancer. The models were assessed with R^2, Mean Square Error (MSE) and Mean Absolute Error (MAE). The small got results outline the benefit of the proposed approach in predicting the good impact of positive emotions regulation on the health of breast cancer patients.

**ID132**

Oscar Gonzalez Miranda and Juan Manuel Ibarra Zannatha.

**Servomotor parameter identification using a Kalman filter with model reference estimator**

**Abstract:** In this work, a parameter estimation method is proposed to identify the parameters of a DC servomotor. While the parameters are obtained with a model reference estimator, a Kalman filter is used to get, at the same time, the states of the model. With this method, it is possible to get the process noise also and use it to obtain a better extrapolation of the states and covariance matrix. The performance of the method is measured with experimental results, and it is compared with the dual Kalman filter.

**ID133**

Bruno Gutiérrez Chávez, Jonathan Muñoz Solis, Miguel Ramírez-Barrios, Manuel Mera Hernández, Rodrigo Mora Martínez and Bernardo Flores Ramírez.

**Preliminary experiments with a PI controller for cutting tissue with an electrosurgery unit**

**Abstract:** Electrosurgery is a surgical procedure that applies a high-frequency electrical current to the patient for specific purposes, such as cutting tissue. Electronic devices usually perform this task in an open loop, where the surgeon establishes the desired voltage, current, or power to perform the cut. However, tissue bioimpedance varies due to many factors, such as anisotropy, temperature, humidity, and frequency, which makes the required load unknown during the process. This paper proposes a closed-loop power regulation scheme based on a PI controller for tissue-cutting tasks. The experiments in animal tissue demonstrate that the proposed scheme guarantees the power supply despite changes

in the tissue's bioimpedance. Therefore, the result significantly improves the cutting efficiency compared to open-loop operation.

**ID134**

Eduardo Benito Ramirez, Arturo Maldonado and Maria de La Luz Olvera.

**Effect of Doping ZnO Films with Cu on the Decoloration of Methylene Blue by Photocatalysis**

**Abstract:** This work presents results from examining thin films of Zinc Oxide (ZnO) and Copper-doped Zinc Oxide (ZnO:Cu) as photocatalysts for degrading Methylene Blue (MB) in aqueous solutions. Films were deposited on soda-lime glass substrates at temperatures from 450 to 525°C and thicknesses from 200 to 1370 nm using the Pneumatic Pyrolytic Spray technique. Doping with Cu aimed to enhance photocatalytic efficiency. Structural, optical, morphological and compositional properties were analyzed using X-ray Diffraction (XRD), UV-Vis Spectrophotometry, Scanning Electron Microscopy (SEM), and secondary ion mass spectrometry (SIMS). ZnO and Cu-doped ZnO films displayed a hexagonal wurtzite-like structure and good homogeneity. Photocatalytic degradation of MB was tested under UV light at 254 nm for 5 h, obtaining a degradation of 99.97% for Cu-doped ZnO films compared to 90% for pure ZnO. The study carried out in this work confirms the efficacy of Cu-doped ZnO films for degradation of organic contaminants in water by low-cost deposition techniques.

**ID135**

Claudia Rigel Duran, Filiberto Muñoz, Eduardo S. Espinoza and Benjamín N. Trinidad.

**Real-Time Tracking Control Using Adaptive Dynamic Programming for Underwater Vehicles**

**Abstract:** This manuscript presents the real-time experiments of a model-free nonlinear controller based on Adaptive Dynamic Programming (ADP) for an Autonomous Underwater Vehicle (AUV). These types of vehicles exhibit significant coupled nonlinearities and parameter uncertainties. To address this, our approach introduces a data-driven scheme, where open-loop data are collected and used to train a differential neural network for identifying the vehicle's dynamics. Based on the identified model, an ADP scheme with an actor-critic structure is implemented to conduct trajectory tracking experiments for yaw and depth dynamics. Additionally, this study examines the implications of using the ADP algorithm and offers insights for necessary adaptations to achieve successful implementation on an open-source commercial underwater vehicle within the ROS environment, thereby bridging the gap between theoretical concepts and practical experimentation.

**ID136**

Adriana Perez-Navarro and Brisbane Ovilla-Martinez.

**Hardware Architecture for the SHA-3 Family in CRYSTALS-KYBER: Post-Quantum Cryptography**

**Abstract:** With the immediate advances in quantum computing, standard public key cryptosystems are expected to become obsolete. For this reason, Post-Quantum Cryptography (PQC) emerges as a new area of research for developing cryptographic systems that are resistant to conventional and quantum attacks. It could thus replace traditional public-key cryptographic solutions. This work describes the design hardware implementation of one of the most critical components in the NIST-PQC standard, CRYSTALS-Kyber. The symmetric primitives used in Kyber: SHA3-256, SHA3-512, SHAKE-128, and SHAKE-256, all based on the Keccak permutation, are integrated as a parameterizable hardware module. The proposed design focuses on embedded systems with a constraint on resources and power consumption and is implemented on a Xilinx Field Programmable Gate Arrays Artix-7. The efficiency and performance of the proposed architecture are compared in terms of area, frequency, and clock cycles with the state of the art.

**ID137**

Jesús Fausto Córdova-Manzo, Gabriel Vega-Martínez, Cinthya Lourdes Toledo-Peral, Arturo Vera-Hernández, Lorenzo Leija-Salas and Gabriela Flores-Mondragón.

**Hydration Status During the Micturition Cycle Using Bioimpedance for Bladder Monitoring: A Pilot Study**

**Abstract:** This pilot study investigates the variation of bioimpedance and its relationship with hydration status parameters (Total Water, Extra- Intracellular Water, etc.) during physiological bladder filling and micturition to assess the feasibility of BIA for hydration status changes as a bladder monitoring technique during bladder voiding and filling. Bioimpedance measurements were performed with the Biody Xpert instrument on three subjects: two fasted and one breakfasted. These novel results may have important implications for bioimpedance-based diagnostics.

**ID139**

Carlos Aguilar-Ibanez, Miguel Suarez-Castanon, Belem Saldivar, Julio Mendoza-Mendoza and Manuel Jimenez-Lizarraga.

**A Robust trajectory tracking problem solution for a PVTOL system under crosswind**

**Abstract:** This paper proposes a solution for the tracking trajectory problem for a Planar Vertical Takeoff and Landing (PVTOL) aircraft disturbed by crosswind. The proposed approach combines a slide mode control of integral type to accomplish the trajectory tracking problem and a discontinuous controller to counteracts online the disturbances effect.To assess the proposed approach performance, a numerical simulation was carried out, having obtained satisfactory results.

**ID141**

Ernesto Lopez-Mellado and Néstor Martínez-Medina.

**Synthesis of WFN from Reduced Event Logs based on Event Precedence Structures**

**Abstract:** This paper presents a method to build workflow nets (WFN), a subclass of Petri nets, from sets of event traces (called event logs) based on event precedence structures. Event logs contain few traces that have common sub-sequences of length two or more events. Event structures are similar to partial order relations that are derived from event precedence relations drawn from traces. The method includes several steps regarding the processing of the event structures and the building of the WFN.

**ID142**

Ramon Eduardo Cortina, Janette Arminda Magaña Cortes, Abraham Hernández Jiménez, Fernando Perez Escamiroza, Daniel Lorias Espinoza and Arturo Minor Martinez.

**Artificial Vision System for Physical Activity Practice for People with Visual Impairment**

**Abstract:** Visual impairment is a congenital or developed condition, sometimes it tends to affect from childhood to old age, it can be permanent or treated with a previous diagnosis, sometimes it is corrected with special lenses, and in other cases, expensive surgeries are required. Studies have shown a decrease in physical activity, an increase in sedentary lifestyles, and the probability of developing diseases such as obesity and overweight as a result. The World Health Organization recommends physical activity to maintain good health for people with this condition. This work presents the development of a system for correcting the orientation of visually impaired people while practicing walking as a physical activity, using image processing and implementing computer vision. The system provides feedback to the user with vibrations and sounds to correct its trajectory, using existing technologies and algorithms such as the Hough Transform. To prove its performance, the system was tested on people in simulated blindness conditions on athletic tracks. The subjects walked 100 meters in a straight line using the device. The results show that the device can keep the user walking in a straight line and correct directional changes to avoid leaving the lanes of an athletic track.

**ID145**

Hector S. Sanchez-Villegas, Luis G. Trujillo-Franco, Hugo F. Abundis-Fong and Gerardo Silva-Navarro.

**On the evaluation of low-cost piezoelectric sensors in modal testing: A case study.**

**Abstract:** This work addresses the evaluation of the performance of low-cost piezoelectric sensors in a modal analysis test. A case study is presented where a set of frequency response functions were obtained using low-cost sensors and then those experimental curves were compared with an independent set of frequency response functions obtained using acceleration sensors with integrated electronics. The performance analysis is based on the validation of the natural

frequencies obtained using a finite element model of the structure proposed as a specimen under test. Three different materials were used in the finite element models of the specimen to determine the best theoretical parameter.

**ID147**

Víctor García Limón, Ernesto Suaste Gómez and Alfredo Cruz Orea.

**Ferromagnetic membrane pore opening control and laser pattern analysis**

**Abstract:** The electrospinning technique has been employed in the fabrication of various applications, such as sensors, filtration equipment, drug dispensers, and others. Currently, manufacturing processes have advanced to enhance precision in membrane orientation and morphology, thereby enabling control over nanofiber diameter and alignment. However, once fabrication is complete, this morphology becomes fixed. This study presents an analysis of modifying pore openings in ferromagnetic membranes under a magnetic field. The analysis is supported by specialized equipment designed for analyzing laser-projected patterns. The observed behavior shows a clear dependence on the voltage applied to the electromagnet generating the magnetic field. It is proposed that future advancements will improve control, potentially affecting the flow of both light particles and liquids.

**ID148**

Camila Sofía Sánchez García, Jorge Said Cervantes-Rojas and Eduardo Steed Espinoza Quesada.

**Fuzzy-Based Disturbance Rejection Control via Integral Sliding Mode for a Quadrotor Aerial Vehicle**

**Abstract:** This work deals with an adaptive disturbance rejection controller which combines the equivalent control based integral sliding mode control (ISMC) strategy and a Mamdani fuzzy inference system (FIS) for trajectory tracking of a quadrotor vehicle subject to Dryden-type wind gusts. The FIS carries out an on-line estimation of the time constant of a low-pass filter (LPF) to extract the equivalent control from the discontinuous control signal. This strategy dynamically estimates the disturbances and uncertainties acting on the plant. The estimated disturbances are compensated via a feedback control law making the system insensitive to these undesired effects. Finally, numerical simulations to evaluate the proposed controller performing a simulated quadrotor flying inspection task are presented.

**ID149**

Jesús Fausto Córdova-Manzo, Gabriel Vega-Martínez, Arturo Vera-Hernández, Lorenzo Leija-Salas and Josefina Gutiérrez-Martínez.

**Finite Element Model for Parameterization of Adipose Tissue Thickness to Assess Near-Infrared Infrared Beam Penetration: A First Approach**

**Abstract:** The aim of this paper is to determine the critical adipose tissue thickness at which Near-Infrared Spectroscopy infrared beam penetration ceases by increasing the adipose tissue thickness (1 mm – 50 mm), we identified the depth at which the NIRS beam no longer penetrates effectively. Furthermore, critical thickness is related to body fat composition in different populations (order by gender & body mass index). The results of this study provide insights into the limitations of NIRS detecting and analyzing physiological parameters in the presence of varying tissue compositions, and these classifiers also determine which subjects are eligible to perform NIRS studies.

**ID150**

Carlos Ernesto Vazquez-Garcia, Jose Elias Perales-Mayorga, Vicente Parra-Vega and Nadia Vanessa Garcia-Hernandez.

**Navigation in a 3D Virtual Environment under Continuum Soft Robot Guidance: A Preliminary Study**

**Abstract:** Haptic guidance has been studied to promote sensory-based decision making and motor learning using rigid-body haptic robots, however at the expense of complex intertwined byproducts of motor skill learning and navigation synchronicity. Studies suggests further research is needed for an effective skill transfer from directional guidance cues to acquire navigation competence, due to haptic cues interfere to motor patterns. There arises the question on how a hyperviscoelastic continuum soft-body robot (cSR) used as a haptic robot may contribute in this matter. In this paper, we explore directional cues (without force cues) conveyed by a cSR to enhance navigation skills in complex 3D immersive

virtual reality environments. Volunteers held the cSR in their right hand to receive 3D directional stimuli, generated through the controlled active deformation of the cSR, while using the control handheld of an Oculus system in their left hand to dictate the orientation and movement of their avatar within a 3D virtual environment. A preliminary experimental study with six volunteers was conducted to evaluate the feasibility of using the soft robot to convey navigational cues within a 3D virtual environment. The results showed that volunteers successfully perceived directional cues, following similar trajectory and covering comparable distances to those achieved using only visual stimuli, demonstrating the effectiveness of the soft robot. This study suggests that a larger sample is needed to ensure scalability of results, as well as further investigation into the integration of haptic and visual stimuli for more conclusive findings.

**ID154**

Giovanni Caicedo, Diana Peralta Garcia, Jaime Andres Perez Taborda and Liliana Vera Londoño.

**Low-Cost Portable Device for Water Quality Monitoring**

**Abstract:** This paper presents the design of a low-cost electronic multiparametric probe for in situ water monitoring. We called this prototype Citizen Aqua Probe, which integrates different electronic components and commercial sensor modules to determine parameters of temperature, potential of hydrogen (pH), total dissolved solids (TDS), and electrical conductivity (EC). We calibrated the sensors using liquids with very well-known parameters of pH and CE depending on the temperature, and the results were compared with those obtained with commercial probes to evaluate the reliability of our prototype, showing a good agreement with the analyzed data in reference samples. The system's designed architecture and the software implementation will be presented in this paper, showing the advantages of the implemented prototype. The location of electronic components in a unique and small box obtained with a 3D printer makes this prototype very compact, portable, and adequate to support the ambient conditions. Considering that we implemented the prototype with low-cost electronic sensors and components, this prototype is very competitive for use in remote areas due to its good cost-benefits, and the implemented software allows a customized application for data analysis and visualization.

**ID155**

Luis E. Cruz-Carrasco, Marcos A. Perez-Espinoza, Dulce Martinez-Peon, Vicente Parra-Vega, Nadia Garcia-Hernandez and Xochitl A. Ortiz-Jimenez.

**Towards an Online Brain Computer Interface based on Binary Kinesthetic Motor Imagery Paradigm**

**Abstract:** One of the main challenges of Brain-Computer interfaces (BCI) is guaranteeing their potential feasibility and viability in real-time scenarios, such as commanding online external agents like wheelchairs, exoskeletons, and spellers. Significant difficulties exist in eliciting volitional electroencephalographic (EEG) events and measuring and processing them. It stems from the fact not only that it is unnatural to exhibit deliberately and voluntarily an EEG event, in addition to poor EEG signal-to-noise ratio, but bidirectional afferent-efferent loops intertwine related events of sensing, decision-making, and actions, affecting the volitional mental state that drives EEG activation regions. Overall, complex issues of sensitivity, specificity, efficiency, usability, time delay, and information transfer rate remain significant concerns for BCI. These complexities have led researchers to study novel paradigms, including kinesthetic motor imaging (KMI), to improve BCI status. This manuscript studies binary KMI-BCI classification toward online applications. The EEG signals were processed using independent component analysis for demixing signals, wavelets, the Hurst exponent for characterization, and a multilayer perceptron for classification. Five metrics are analyzed to conclude the trade-off between epoch size accuracy and latency in a five-participant protocol. The obtained accuracy for 200, 300, 400, 500, 600, 700, 800, and 900 ms epoch sizes were 83, 86, 82, 88, 86, 87, 85, 88, and 87%, respectively. These results provide clear insights into balancing the feasibility and viability of a real-time binary-class KMI-BCI with 83% accuracy at less than 250 ms of latency within the reachable specifications to command a dynamical agent.

**ID156**

Carlos Minutti.

**Unraveling the Complex Interplay Between Socioeconomic Status, Air Pollution, and Heart Disease Hospitalizations in an Urban Population**

**Abstract:** Cardiovascular diseases (CVDs) remain the leading cause of global mortality, with significant contributions from ischemic heart disease and stroke. This study explores the multifaceted risk factors for heart disease hospitalizations in Mexico City, focusing on socioeconomic status (SES) and air pollution. Using a dataset of 11,031 hospitalization records from 2015 to 2020, we employ negative binomial regression and Gradient Boosting Machine (GBM) models to analyze the effects of economic and social SES components, as well as air pollution indices, on the frequency and severity of hospitalizations. Our results reveal that both economic and social aspects of SES, alongside exposure to particulate matter and carbon monoxide, significantly impact hospitalization rates for various heart disease categories. The study highlights that socioeconomic disparities and environmental pollution are crucial determinants of cardiovascular health, emphasizing the need for targeted public health policies and interventions in urban settings. By integrating detailed SES indicators and pollution data, our findings provide a nuanced understanding of the complex relationships influencing heart disease hospitalizations.

**ID157**

Mohammad Sakib, Md. Asadullah, Sharif Mohd Shams, Md. Delowar Hossain, Md. Monzu Uddin and M. Mofazzal Hossain.

**Eczema and Seborrheic Keratoses: A Novel Method for Skin Disease Classification Using Image-Based Analysis**

**Abstract:** The human skin, which is the biggest organ and the outermost layer of the body, has seven layers that serve to shield interior organs. Because of its broad role in the integumentary system, maintaining the health of the skin is essential. Skin problems present substantial classification challenges for medical professionals since they include a wide spectrum of diseases, including dermatoses. Consequently, they are depending more and more on machine learning (ML) technologies to help them predict and categorize these diseases. In the discipline of imaging, convolutional neural networks (CNNs) have proven to function on par with or even better than human capabilities. In this study, we propose a novel CNN architecture designed to classify two specific skin diseases: Eczema (symptoms on legs and hands) and Seborrheic Keratoses (symptoms on ears and skin). Additionally, we compare the performance of six ML algorithms to determine the most accurate model. Utilizing the Dermnet 2021 DATASET, which contains 2,332 images and is publicly available on Kaggle, we conducted training and testing of our proposed method. Our results indicate that the proposed CNN model outperforms many state-of-the-art methods, achieving an accuracy of 91.1% and an F1-score of 92.3%. Among the ML models evaluated, Linear Regression (LR) achieved the highest accuracy of 78.41% and an F1-score of 79.12%.

**ID158**

Hugo Yañez-Badillo, Daniel Galvan-Perez, Francisco Beltran-Carbajal and Ivan Rivas-Cambero.

**Integration of Virtual Vibration Absorbers in UAV Motion Control Design for Monitoring Civil Structures in Dam Engineering**

**Abstract:** This paper explores the innovative use of virtual vibration absorbers in the motion control systems of unmanned aerial vehicles (UAVs) specifically for civil structure monitoring in dam engineering. By integrating virtual vibration absorbers, UAVs can achieve greater stability and accuracy in data collection, leading to more precise monitoring of infrastructure health in disturbed scenarios. The research explores the design, implementation, and performance evaluation of these systems, highlighting their potential for enhancing UAV efficiency and reliability in civil engineering applications. Numerical simulations are included to illustrate the effectiveness of the proposed methodology. The principal findings and conclusions of the research are also presented.

**ID159**

Josefina Gutierrez-Martinez, Jorge Airy Mercado-Gutierrez, Luis Eduardo Pachecho González, Jimena Quinzaños-Fresnedo, Ana G. Ramirez-Nava, Guadalupe Benitez-Sanchez and Oscar Yanez-Suarez.

**Network Connectivity Measures to Assess Changes in Brain Activity of Stroke Patients**

**Abstract:** Most stroke survivors present hemiplegia or hemiparesis, which impair severely upper limb motor function and independence. Clinical scales are commonly used to evaluate the effects of post-stroke rehabilitation programs.

However, those scales rely on subjective assessment of patient's behavior or physical state, requiring highly trained specialists. In this work, the use of basic connectivity parameters based on graph theory applied to EEG signals, was explored as a quantitative tool to evaluate the effects in brain activity of an upper limb rehabilitation intervention. The approach was tested on a group of six stroke patients, using routine, resting-state EEG signals recorded from frontal, central and parietal regions, before and after their participation in an upper limb rehabilitation intervention using a P300-based Brain Computer Interface coupled to a Functional Electrical Stimulator. Brain connectivity was estimated through two complex parameters: node degree and clustering coefficient, calculated from two phase synchrony metrics (weighted phase lag index and spectral coherence) in the alpha (8-12 Hz) and lower beta (13-19 Hz) frequency bands. After the intervention, the average node degree for these patients was increased at central and frontal EEG electrodes, and the average clustering coefficient was increased at parietal and central positions. Furthermore, clinical scales showed improvements in upper limb function after the intervention. The next steps are to analyze the relationships between clinical and brain connectivity measures, and to follow up the patient brain and clinical state at mid and long-term spans.

**ID161**

Zhengmao Ye.

**Computational Complexity Reduction in Feature Detection via Nonlinear Component Analysis and Information Quantitative Synthesis**

**Abstract:** Feature detection exemplifies a promising area in digital image processing. Local features manifest the distinct and informative details in sub-images. Global features instead provide holistic aspects across entire digital images. To minimize the information loss, the large memory space and high dimensional data are necessary in image processing. It gives rise to the computational complexity issues. Being the alternative solutions, some computational efficiency enhancement and dimensionality reduction schemes are potentially needed. Principal component analysis (PCA) is traditionally a dominating technique. However, nonlinear component analysis (NCA) will be more powerful to deal with multivariate large dimensional nonlinear problems up to infinite dimensionality. NCA is thus applied for dimensionality reduction in context for feature detection cases covering practical land, sea and space information. The selective set of quantitative metrics based on statistics is well defined and proposed for information quantitative synthesis, including the discrete entropy, relative entropy and mutual information in the frequency domain, together with the dissimilarity, contrast and correlation in the spatial domain in order to ensure the information integrity from diverse aspects. Numerical simulations verify the significance of the NCA approach.

**ID164**

Cristian Ayala, Manuela Londoño, Samuel Lopez, Vanesa Triana, Daniela Payares and Juan Sebastian Sanchez-Gomez.

**Transportation models and unsupervised learning methods to minimize food waste in schools of Medellin**

**Abstract:** This research creates alternative vehicle routing plans for schools and marketplaces using unsupervised transportation models and learning methods. This initiative seeks to optimize food distribution logistics and reduce waste, thereby improving access to fresh food and mitigating food insecurity. The methodology involves the application of transportation models and unsupervised learning techniques to develop efficient vehicle routing plans. This study utilizes the K-means algorithm to identify vulnerable and privileged areas in Medellín, focusing on schools and marketplaces. Data collection and preparation are crucial steps, ensuring that the information accurately reflects the realities of food distribution. The gravity method is also employed to optimize delivery routes by considering factors such as distance, traffic, and vehicle load capacity. The vulnerable areas and the establishment of collection points for food aid were identified. The K-means algorithm helped determine centroids for both distribution and collection centers, facilitating the planning of logistics for food redistribution. A detailed map was created to visualize these zones, which will serve as essential tools for planning relief activities. The study also highlights the significant amount of food wasted in Medellín's marketplaces, emphasizing the need for effective routing to minimize this waste. The project achieved its objectives by identifying strategic locations for distribution centers and optimizing delivery routes. However, it faced challenges such as the lack of real-time data on population and food distribution. Future recommendations include integrating advanced data collection technologies and implementing a route management system using machine learning algorithms to adapt to changing conditions.

**ID165**

María Lesvia Escobar-Hernández, Jesús Fausto Córdova-Manzo, Daniel Acosta-Mares, Arturo Vera-Hernández, Lorenzo Leija-Salas, Josefina Gutiérrez-Martínez and Jesús Fausto Córdova-Escobedo.

**Urological Condition Simulator for Accurate Uroflowmeter Calibration and Testing**

**Abstract:** This project describes the development of a urological condition simulator designed to test uroflowmeters. The simulator reproduces various urological conditions by programming voltage sequences to control a pump, thus mimicking specific urinary flow patterns. The main conditions simulated are benign prostatic obstruction (BPO), overactive detrusor, urethral stricture and underactive detrusor. Each condition is modeled using parameters such as maximum flow velocity (Qmax), mean flow velocity (Qave) and flow duration. Using an ESP32 microcontroller, the system generates precise voltage sequences that control an infusion pump, producing accurate urinary flow patterns. The goal of the project is to provide a reliable and consistent method for evaluating the performance of flowmeters in various clinical scenarios, ensuring their accuracy and reliability in the diagnosis and monitoring of urinary tract conditions