”Dunărea de Jos” University of Galați

Scientific Conference of Doctoral Schools

Perspectives and challenges in doctoral Research

14th Edition of SCDS-UDJG

11th and 12th of June 2026

BOOK OF ABSTRACTS

UNIVERSITAS GALATIENSIS

Dunărea de Jos" University of Galați

DOCTORAL SCHOOL OF FUNDAMENTAL SCIENCES AND ENGINEERING

Scientific Conference of Doctoral Schools

Perspectives and challenges in doctoral Research

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11th and 12th of June 2026

BOOK OF ABSTRACTS

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CONFERENCE PROGRAMME

THURSDAY – June 11, 2026

08:00-10:00	Invited plenary lectures
09:00-11:00	Participants registration
10:00-13:00	Invited lectures Oral presentations in concurrent sections
13:00-14:00	Lunch (building D - 1st floor)
14:00-16:00	Oral presentations in concurrent sections
16:00-16:30	Coffee break (building D - 1st floor)
16:00-18:00	Oral presentations in concurrent sections
18:00	Cultural evening

FRIDAY – June 12, 2026

09:00-10:30	Oral presentations in concurrent sections
10:30-11:00	Coffee break (building D - 1st floor)
11:00-13:00	Posters session
11:00-13:00	Workshop
13:00-14:00	Awarding ceremony. Closing ceremony
14:00-15:00	Lunch (building D - 1st floor)

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1. INVITED LECTURE

SECTION 5: ADVANCED RESEARCH IN ELECTRICAL / ELECTRONIC ENGINEERING, SYSTEM ENGINEERING AND INFORMATION

IL.5.1.

EVOLUTION OF THE CONTROL STRATEGIES FOR PARALLEL ACTIVE POWER FILTERS: FROM CLASSICAL ALGORITHMS TO ARTIFICIAL INTELLIGENCE

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ABSTRACT

This paper presents an exhaustive analysis of the current state of parallel active power filters (SAPFs), essential tools in combating harmonic pollution in modern power grids. The review explores the transition from conventional control methods, such as PI regulators and hysteresis techniques, to advanced Model Predictive Control (MPC) solutions and artificial intelligence algorithms, including LSTM neural networks. The main techniques for identifying the reference current (p-q theory, d-q theory) and their performance in relation to the strict regulations of the IEEE 519 standard are critically analyzed. The paper highlights how new computing technologies allow SAPFs not only to reduce the total harmonic distortion (THD) index below the 5% threshold, but also to ensure dynamic compensation of reactive power with a unity power factor. The conclusions of the synthesis indicate that the future of active filters lies in the ability to proactively anticipate nonlinear loads through the use of Big Data and Deep Learning.

Key words: Power Quality, Active Power Filter (SAPF), Harmonics, Predictive Control, Artificial Intelligence, Reactive Power Compensation.

2. ORAL PRESENTATIONS

SECTION 5: ADVANCED RESEARCH IN ELECTRICAL / ELECTRONIC ENGINEERING, SYSTEM ENGINEERING AND INFORMATION TECHNOLOGIES

OP.5.1.

OPTIMIZATION OF THE OPERATION OF A SINTER MACHINE THROUGH AUTOMATIC SPEED CONTROL

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ABSTRACT

This paper presents a method for optimizing the operation of an industrial sinter machine through automatic speed control based on the temperature measured at the process output. Sinter processes play a critical role in various industrial applications, where maintaining consistent material properties and process stability is essential. In this context, the temperature of the material at the machine outlet represents a key parameter, directly correlated with the quality of the final product. The proposed solution is based on an electrical drive system equipped with a variable frequency drive (VFD), integrated into a closed-loop control structure. The rotational speed of the motor is automatically adjusted according to temperature variations, ensuring that optimal operating conditions are maintained. This approach allows dynamic adaptation to load changes and process disturbances. The study analyzes the system performance in terms of stability, response time, and energy efficiency. The results demonstrate that speed regulation based on temperature feedback leads to significant improvements in process quality, reduction of energy consumption, and increased reliability of the equipment. The proposed method has high applicability in industrial environments and can be extended to other processes where indirect control of technological parameters is achieved through speed regulation.

Key words: automatic speed control, advanced control algorithms, variable frequency drive, industrial automation, energy efficiency, and process optimization.

OP.5.2.

Analysis of Operating Conditions and Current Calculation in a Ship Electrical System Using ETAP

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ABSTRACT

This paper presents the analysis of operating conditions and the calculation of electrical currents in a ship power system using the ETAP software environment. Ship electrical systems are complex and require reliable operation under varying load conditions, making accurate analysis essential for ensuring safety, efficiency, and continuity of service. The study focuses on modeling a representative ship electrical network, including generators, distribution buses, and major electrical consumers. Using ETAP, different operating scenarios are simulated in order to evaluate load flow distribution and current levels throughout the system. Special attention is given to critical conditions such as peak load operation and fault scenarios, which significantly influence system performance. The results obtained from the simulations provide insights into current distribution, system stability, and potential overload conditions. The analysis highlights the importance of proper system design and the use of advanced simulation tools in predicting the behavior of electrical networks in marine environments. The proposed approach demonstrates the effectiveness of ETAP in analyzing ship electrical systems and supports the optimization of their operation and design.

Key words: ship power system, ETAP, load flow analysis, current calculation, short-circuit analysis.

OP.5.3.

ANALYSIS OF THREE-PHASE INDUCTION MOTOR OPERATION UNDER SEVERE CONDITIONS

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ABSTRACT

This paper investigates the operational performance of three-phase induction motors deployed in high-demand industrial applications, specifically within underground conveyor systems. While renowned for their structural robustness, these machines face significant reliability challenges when operated in hostile environments characterized by excessive humidity and deficient cooling thermal management. Furthermore, the study evaluates the impact of Variable Frequency Drive (VFD) integration on the motor's overall resilience, highlighting potential compatibility issues between the drive system and the motor's constructive design under adverse conditions. The research focuses on monitoring and analyzing the behavioral patterns of an induction motor operating under a severe dynamic regime in a subterranean environment, providing insights into the factors that lead to unpredictable performance and reduced service life.

Key words: three-phase induction motor, severe operating conditions, high humidity, thermal management, heavy-duty dynamic.

OP.5.4.

TRANSFER LEARNING FOR AUTOMATED MINERAL RECOGNITION USING ROBOTIC VISION

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ABSTRACT

This study presents an automated mineral classification system combining robotic image acquisition with deep learning, targeting three economically significant mineral classes: iron ore (hematite/magnetite), coal (bituminous), and bauxite. A custom dataset consisting of 450 images was obtained using a Braccio robotic arm equipped with a camera, performing five independent grasps across 50 specimens per class at varying orientations. Images were captured at 640×480 resolution and preprocessed to 224×224 pixels for network input. A convolutional neural network based on the Xception architecture was employed via transfer learning, augmented with global average pooling, dropout regularization, and fully connected layers for ternary classification. Fine-tuning of the final 30 layers at a reduced learning rate enabled the model to adapt high-level visual features — including shape, texture, and color — to the mineral domain without catastrophic forgetting of pretrained representations. Training proceeded for 90 epochs using the Adam optimizer with cross-entropy loss, and online data augmentation was applied to improve generalization. Evaluation on a held-out test set yielded an overall accuracy of 94.44%, with macro-averaged precision, recall, and F1-score of 0.945, 0.944, and 0.944, respectively. Iron ore achieved the highest per-class accuracy at 96.7%, while coal and bauxite each reached 93.3%. Misclassifications were primarily attributable to weathering-induced color shifts and mineralogical variation in bauxite specimens. These results demonstrate the viability of robotic vision combined with transfer learning for reliable, low-latency mineral identification in industrial settings.

Key words: mineral classification, deep learning, image recognition.

OP.5.5.

DEEP LEARNING CLASSIFICATION OF FELINE AND CANINE THORACIC X-RAYS FROM DICOM DATA USING TRANSFER LEARNING

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ABSTRACT

This work presents a deep-learning pipeline for binary classification of veterinary thoracic X-rays into Feline (Cats) and Canine (Dogs) using DICOM data. The dataset was organized with stratified train/validation/test splits to preserve class distribution and ensure reproducible evaluation. A transfer-learning approach based on ResNet-18 was implemented in PyTorch, with adaptations for medical grayscale imaging, including DICOM-specific preprocessing (modality/VOI LUT handling, intensity normalization, and contrast scaling), data augmentation, and class-imbalance-aware optimization.

Model performance was evaluated beyond accuracy by reporting precision, recall, F1-score, balanced accuracy, ROC-AUC, and confusion matrices, together with per-image prediction logs (true label, predicted label, and confidence). In our best configuration, the model achieved approximately 87.9% test accuracy, macro-F1 around 0.79, and ROC-AUC around 0.90, indicating good separability but reduced sensitivity for one class. Error analysis on high-confidence misclassifications suggests that overlapping anatomical patterns and variability in acquisition quality remain important challenges.

The proposed pipeline demonstrates a practical, reproducible framework for species recognition from radiographs and provides transparent evaluation artifacts (detailed prediction tables and visual galleries of correct/incorrect cases) to support clinical interpretability. Future work will focus on domain-specific preprocessing refinements, stronger architectures, and cross-site validation to improve robustness and generalization for real-world veterinary deployment.

Key words: Veterinary radiology; deep learning; ResNet-18.

OP.5.6.

A MULTIMODAL MACHINE LEARNING FRAMEWORK FOR EARLY DETECTION OF EXTREME EVENTS IN FINANCIAL MARKET

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ABSTRACT

Financial markets exhibit strong non-stationarity, complex cross-asset interactions, and abrupt regime shifts, making the detection of extreme events particularly challenging. Rare but impactful movements associated with systemic stress require models capable of integrating heterogeneous data while handling severe class imbalance. In this study, we propose a multimodal machine learning framework for the early detection of extreme market movements, combining market indicators, volatility dynamics, cross-asset relationships, and macroeconomic variables. Extreme events are defined dynamically using rolling percentile thresholds on future returns, enabling adaptation to changing market conditions. A gradient boosting model is used to estimate the probability of spike events, complemented by a regime- aware thresholding strategy that supports multiple operating modes. The framework is evaluated using a time-series-aware setup across diverse market regimes. Results demonstrate strong predictive performance, achieving a ROC AUC of approximately 0.81 and high effectiveness in ranking risk, with precision exceeding 0.86 among top predictions. Calibration analysis further indicates that predicted probabilities provide meaningful risk estimates. These findings suggest that combining multimodal signals with regime-aware decision strategies is a promising direction for early warning systems in financial markets.

Key words: financial anomaly detection, multimodal machine learning, time-series modeling.

OP.5.7.

SHORT TERM RESIDENTIAL LOAD FORECASTING USING NARX MODEL AND ENVIRONMENTAL EXOGENOUS INPUTS

Dan Ionut Ghiorghita, Marian Gaiceanu

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Abstract

Accurate short-term electrical load forecasting is an important requirement for residential energy management, peak-demand reduction, and demand-side optimization in smart grid environments [2],[3]. This paper proposes a data driven forecasting framework for household appliance energy consumption based on nonlinear autoregressive models with exogenous inputs, implemented in Matlab. [1],[2] The study uses the public "Appliances Energy Prediction" dataset which contains 19,735 multivariate time series samples recorded at 10 minutes interval over approximately 4,5 months, including appliance energy use, indoor temperature and humidity measurements and wather related variables. The proposed methodology uses lagged load values together with exogenous environmental variables and time-derived predictors to estimate future demand over short forecasting horizons. The nonlinear ARX/NARX-type model is benchmarked against simpler baseline predictors in order to assess improvements in dynamic forecasting accuracy and robustness under changing occupancy-related and environmental conditions [3]. Performance is evaluated using standard regression criteria such as RMSE, MAE, and MAPE. The expected contribution is a reproducible AI-based forecasting architecture suitable for building energy management, adaptive scheduling, and intelligent decision support in low-voltage smart-energy applications.

Key words: Short-term load forecasting, nonlinear ARX, NARX, MATLAB, smart home energy management, exogenous inputs, time-series prediction.

OP.5.8.

PHOTOVOLTAIC SYSTEMS ABOVE AQUACULTURE PONDS: SUSTAINABLE SOLUTIONS FOR ENERGY INFRASTRUCTURE

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ABSTRACT

Integrating photovoltaic (PV) systems above aquaculture ponds is an emerging design approach with substantial potential to reduce carbon emissions and improve energy efficiency in the aquaculture sector. These configurations enable on-site renewable energy generation, reduce water evaporation, and contribute to thermal stabilization, all of which can support the physiological condition of aquatic organisms and improve farm productivity. Evidence from Asia and Europe demonstrates the feasibility of aquavoltaic systems, highlighting their compatibility with both recirculating aquaculture systems and open-pond environments. In Taiwan, PV shading structures have been deployed above fish ponds, while European research emphasizes opportunities to couple PV installations with advanced digital water-quality monitoring technologies. This study provides a design-oriented conceptual assessment of a modular PV system proposed for the Brateș experimental aquaculture laboratory in Romania. Because the system is not yet operational, the analysis focuses on estimating its expected energy performance, structural integration requirements, and potential microclimatic effects on reproduction ponds. By outlining the system architecture and anticipated functional outcomes, the study establishes a feasibility-based foundation for future implementation and scaling of solar-powered aquaculture infrastructure once the system becomes fully operational.

Key words: Aquavoltaics, Photovoltaic systems, Sustainable aquaculture, Renewable energy integration, Aquaculture ponds, Microclimate regulation, Energy efficiency, Smart aquaculture infrastructure.

3.POSTERS

SECTION 5: ADVANCED RESEARCH IN ELECTRICAL / ELECTRONIC ENGINEERING, SYSTEM ENGINEERING AND INFORMATION TECHNOLOGIES

PP.5.1.

AUTOMATIC CONTROL OF A ROTARY FEEDER FOR ACHIEVING THE IMPOSED MATERIAL FLOW RATE

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ABSTRACT

This paper presents the implementation of an automatic control system for a rotary feeder used in industrial processes, aiming to achieve the imposed material flow rate. The control system is based on a closed-loop structure, where the material flow is indirectly regulated by monitoring a relevant technological parameter, namely the material level. The control strategy employs a PID controller acting on the error between the reference value and the measured level. The resulting control signal is further weighted and correlated with the operating parameters of the installation, ensuring dynamic adaptation to load variations and operating conditions. The final control command is applied to the rotary feeder, enabling accurate flow regulation. The system performance is analyzed in terms of stability, response time, and control accuracy. The results demonstrate that the use of automatic control allows maintaining a stable and optimal material flow, contributing to improved process efficiency and reduced fluctuations. The proposed solution is applicable to a wide range of industrial processes where accurate material dosing is essential, highlighting the benefits of automation in process optimization.

Key words: PID controller, material flow rate, closed-loop control, industrial automation, rotary feeder.

PP.5.2.

ANALYSIS OF THE OPERATING PRINCIPLE OF OVERHEAD CRANES WITH SUSPENDED LOADS OF DIFFERENT MASSES

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ABSTRACT

The present article presents the lifting and lowering mechanisms, namely overhead cranes, witch are essential equipment for material handling in industries such as metallurgy, transportation, and warehouse management. The studied topic aims to highlight the operating principle of overhead cranes, considering the handling of suspended loads with different masses. The nonlinear equations of motion are solved numerically using the ode45 method for different values of the load masses. The influence of mass on the trolley displacement and on the pendulum oscillations is investigated. The study involves the analysis of the main operating parameters and a comparison between loads of different masses, providing a useful perspective for the control and design of crane or suspended transport systems. The obtained results and the general conclusions will also be presented.

Key words: cranes, electric drive system, suspended loads, nonlinear equations, numerical simulation.

PP.5.3.

AI BASED FAULT DETECTION IN GRID CONNECTED PHOTOVOLTAIC SYSTEMS

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ABSTRACT

Reliable fault detection in grid-connected photovoltaic systems is essential for maintaining energy yield, operational safety, and maintenance efficiency in renewable-energy installations [2],[3]. This paper proposes an artificial-intelligence-based framework for the detection and classification of faults in photovoltaic systems using multisensor electrical measurements and MATLAB-based processing. [1] The proposed workflow includes signal segmentation, feature extraction in the time and frequency domains, and supervised classification using machine-learning models such as support vector machines, shallow neural networks, or sequence-based predictors. [1],[2] Because the dataset includes noisy high-frequency measurements and realistic operating variability, it is well suited for evaluating the robustness of AI-based diagnostics under practical conditions. The expected outcome is a MATLAB-ready diagnostic framework for intelligent PV monitoring, early fault recognition, and predictive maintenance support in converter-interfaced renewable-energy systems.

Key words: Photovoltaic systems, fault detection, fault classification, machine learning, MATLAB; predictive maintenance, multisensor data.

PP.5.4.

ADVANCED CONTROL METHOD FOR INDUSTRIAL CRANE: INTEGRATING TRAJECTORY TRACKING WITH ACTIVE OSCILLATION DAMPING

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ABSTRACT

Reliable fault detection in grid-connected photovoltaic systems is essential for maintaining energy yield, operational safety, and maintenance efficiency in renewable-energy installations [2],[3]. This paper proposes an artificial-intelligence-based framework for the detection and classification of faults in photovoltaic systems using multisensor electrical measurements and MATLAB-based processing. [1] The proposed workflow includes signal segmentation, feature extraction in the time and frequency domains, and supervised classification using machine-learning models such as support vector machines, shallow neural networks, or sequence-based predictors. [1],[2] Because the dataset includes noisy high-frequency measurements and realistic operating variability, it is well suited for evaluating the robustness of AI-based diagnostics under practical conditions. The expected outcome is a MATLAB-ready diagnostic framework for intelligent PV monitoring, early fault recognition, and predictive maintenance support in converter-interfaced renewable-energy systems.

Key words: Photovoltaic systems; fault detection; fault classification; machine learning; MATLAB; predictive maintenance; multisensor data

PP.5.5.

AN ANALOG COMPUTER MODEL PROPOSAL FOR NANOROBOTS USED FOR RETINA TREATMENT

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ABSTRACT

The design of a semi-autonomous retinal surgery system based on nanorobots involves the integration of advanced technologies for navigation, communication, manipulation, and therapeutic substance delivery. An analogue computer based in a small robot in a liquid droplet can pass inside the eye vitreous through osmosis, and transport medical substances, and merge with other such liquid robots, and it can move inside. Droplets may be manipulated with algorithms based on logic operations that automatically compute where droplets are directed using physical computation by synchronous universal logic. Through the coupling of droplets, is proposed a solution with AND, OR, XOR, NOT and NAND logic gates, fanouts, a full adder, a flip-flop and a finite-state machine, and this enables large-scale integration of droplet logic processing..

Key words: Semi-autonomous retinal surgery, nanorobots, analogue computer based robot, liquid droplet, logic operations, droplet logic processing, guidance system for nanorobots.

PP.5.6.

REINFORCEMENT LEARNING FOR MARINE WINCH TENSION CONTROL: PEAK LOAD REDUCTION UNDER IRREGULAR WAVE CONDITIONS

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ABSTRACT

This paper presents a Proximal Policy Optimization (PPO)-based reinforcement learning controller for marine winch tension regulation under irregular wave loading. The proposed agent is trained via curriculum learning with progressively increasing setpoint difficulty (8–18 kN) and wave disturbances, using a reward function that explicitly penalizes peak tension exceedances and drum overspeed. The controller is benchmarked against a conventional proportional-integral (PI) controller under identical conditions, including irregular sea waves and randomized tension setpoints. Statistical comparison across RL and PI episodes demonstrates that the RL controller achieves a significant reduction in peak tension (T_max) of 11.2% on average and 12.8% at the maximum value while maintaining equivalent steady-state tracking accuracy (MeanErr aprox. 1.43 kN). At high tension setpoints (>15 kN), the advantage increases to 14.5% peak tension reduction and 13.7% lower drum speed. An enhanced variant incorporating real-time wave phase anticipation as an additional observation further improves transient rejection. These results demonstrate that deep reinforcement learning offers a viable, data-driven alternative to classical controllers for safety-critical marine winch systems.

Key words: reinforcement learning, proximal policy optimization, marine winch control, tension regulation, wave disturbance rejection, peak tension reduction, curriculum learning, marine systems.

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PP.5.7.

REVIEW STUDY FOR THE EVALUATION OF AUTONOMOUS UAV SYSTEMS AI-GUIDED DRONE INTERCEPTOR SYSTEM

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ABSTRACT

Since the beginning of human history, mankind has always strived to create more effective tools to combat other creatures, including fellow humans. Thus, the use of various animal species, the creation of new weapons, and other means of human progress have always led to new developments, aimed at emulating, replacing, or countering these innovations.

The rapid spread of small unmanned aerial vehicles (UAVs) has raised concerns about public safety and security. In response, small drones are gaining attention as short-range interception platforms due to their flexible mission deployment. The proliferation of unauthorized drones poses serious threats to low-altitude security. Thus, there is a critical need for robust autonomous interception systems.

In this paper, a novel strategy and approach for autonomous interception of fast flying objects is presented. To this end, we have conducted a review of the main approaches and development methods for an autonomous drone interception system guided by artificial intelligence. a sovereign and cost-effective approach to advanced air defense. This study reviews systems based on ArduPilot SITL with ROS 2, with different guidance schemes - Pure Proportional Navigation (PPN), True Proportional Navigation (TPN) and Zero Effort Miss (ZEM). these systems are quite old and outdated, contemporary requirements being those based on other self-piloting configurations. The paper introduces a proper innovative system.

Key words: mathematical modeling, autonomous drone interception system, sovereign and cost-effective approach to air defense.

PP.5.8.

PRELIMINARY ASPECT OF AN AUTONOMOUS AI-GUIDED DRONE INTERCEPTOR SYSTEM DEVELOPMENT

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ABSTRACT

The rapid proliferation of Unmanned Aerial Vehicles (UAVs) necessitates the development of highly agile, autonomous interception systems. This proposal outlines the development of a state-of-the-art, multi-rotor (4 to 8 motors) Autonomous Drone Interceptor.

A critical differentiator of this project is its 100% in-house development architecture. The hardware, firmware, and software are entirely designed, written, and tested by our local team. We rely on zero foreign "black-box" intellectual property, hidden code lines, or restrictive external licenses. This sovereign approach guarantees absolute operational security—ensuring the drone cannot be externally overridden or restricted from tracking specific targets—and provides unparalleled flexibility. If hardware or software modifications are r required, our team can implement and deploy them within days or weeks, rather than months. Preliminary results are presented in this paper.

Key words: mathematical modeling, autonomous drone interception system, sovereign and cost-effective approach to air defense.

PP.5.9.

COMPARATIVE CONTROL SYSTEMS FOR OMNIDIRECTIONAL ROBOTIC PLATFORMS

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ABSTRACT

This study evaluates the performance of four control paradigms—PID, LQR, MPC, and Tube MPC—on the task of tracking a mobile robot equipped with Mecanum wheels. The analysis focuses on the critical trade-off between geometric accuracy (RMS error) and resource efficiency (energy consumption and computational effort). The results demonstrate that while Tube MPC offers the highest accuracy (error below 5 cm), the LQR Balanced solution represents the practical optimum, providing an error reduction of over 50% compared to PID, while maintaining a minimal energy consumption profile (91.1% efficiency).

Key words: Omnidirectional, PID, LQR, MPC, Tube MPC, Mecanum, Wheels.

PP.5.10.

MODEL PREDICTIVE CONTROL OF THE ENERGY CONSUMPTION OF AN ELECTRIC VEHICLE IN THE STANDARDIZED WLTP DRIVING CYCLE

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ABSTRACT

The paper presents the development of a numerical model for the analysis of the energy consumption of an electric vehicle, using the standardized WLTP driving cycle. The model integrates the longitudinal dynamics of the vehicle, the behavior of the battery and the influence of auxiliary consumers, being implemented in MATLAB in discrete time form.

Based on this model, a predictive control of the Model Predictive Control (MPC) type was implemented, which uses a finite prediction horizon to optimize the traction power. The main objective of the control is to reduce the deviation from the imposed speed profile, minimize the energy consumption and maintain the state of charge (SOC) within safe limits.

The simulation results indicate a realistic specific energy consumption, within the range characteristic of modern electric vehicles, as well as a stable evolution of the SOC and battery temperature. The implementation of MPC significantly improves the tracking of the speed cycle and reduces sudden power variations, compared to classic non-recursive control.

Key words: electric vehicle, mathematical modeling, predictive control (MPC), energy consumption, state of charge (SOC), WLTP, battery management, energy optimization.