**ICIT 2020 Abstract**

S. D. Salas, W. Angulo and D. De Cecchis, "A Decoupled Data-Driven Strategy for Estimating Parameters with Nonlinear Dependence," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 17-22.  
doi: 10.1109/ICIT45562.2020.9067157  
Abstract: In this work, we introduce a decoupled data-driven methodology for the online estimation of parameters with nonlinear dependence. Common estimation methods for nonlinear systems rely on the incorporation of the mathematical model under study to the estimation structure. Other variational approaches trend to be more computationally expensive. In contrast, data-driven estimation methods, based on the retrospective cost model refinement (RCMR) algorithm, have demonstrated an efficient and adequate ability in the estimation of parameters. However, a better performance is observed when the estimation structure is divided into several independent sub-structures. The proposed decoupled RCMR strategy is explained and compared with the original structure using numerical examples. The results of the numerical examples show that the proposed strategy exhibits a good trade-off between the velocity of convergence and error minimization.  
keywords: {Estimation;Mathematical model;Parameter estimation;Computational modeling;Data models;Cost function;Numerical models;Nonlinear parameter estimation;data-driven parameter estimation;retrospective cost model refinement},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067157&isnumber=9067096>  
  
A. K. Pal, B. Singh, S. Kamal, S. K. Nagar and J. K. Goyal, "Arbitrary Time Stabilization of a Coupled Tank System: A Contraction based Approach," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 23-28.  
doi: 10.1109/ICIT45562.2020.9067306  
Abstract: In this paper, we discuss stabilization in arbitrary time. The class of free-will arbitrary time stable system is considered. Stability has been analyzed using contraction theory. It is shown that the trajectories contracts towards one another within a given arbitrary time, thus leading to free-will arbitrary time stabilization of the system. The given strategy performs satisfactorily on a benchmark example of the coupled tank system.  
keywords: {Trajectory;Stability;Convergence;Observers;Control system synthesis;Free-will arbitrary time stabilization;backstepping;contraction analysis;coupled tank},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067306&isnumber=9067096>  
  
B. Singh et al., "Controller and Observer Design using Vector Framework with Simplified Contraction Analysis," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 29-34.  
doi: 10.1109/ICIT45562.2020.9067132  
Abstract: This technical note presents the application of simplified contraction analysis using vector framework. In general, conventional approach leads to guaranteeing negative definiteness of the associated Jacobian for ensuring convergence of any pair of trajectories. A vector valued norm is used for simplification of the problem to ensure contraction through the comparison systems. In fact, comparison systems are used for ensuring convergence of the squared distances between any pair of trajectories in a simplified way. We show that by employing this simplified contraction analysis, it is possible to design controller and observer. The methodology is illustrated via a set of representative examples.  
keywords: {Observers;Trajectory;Convergence;Nonlinear systems;Jacobian matrices;Stability analysis;Closed loop systems;Large scale systems;nonlinear system;observer and identification techniques},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067132&isnumber=9067096>  
  
A. Gienger and O. Sawodny, "Data-based Process Monitoring and Iterative Fault Diagnosis using Factor Graphs," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 35-40.  
doi: 10.1109/ICIT45562.2020.9067215  
Abstract: In this paper, an approach for data-based process monitoring and fault diagnosis in dynamical systems is presented. Given data of the nominal operation of a system, the approach determines a set of stochastically dependent variables for each sensor using mutual information. The sets of dependent variables provide information about the system dynamics and the resulting factorization of the probability density function, which is represented as a factor graph. The probability density function is estimated by non-parametric kernel density estimation using Gaussian kernels. Based on the nominal system description provided by the factor graph, the probability of abnormal events and faults is calculated and their root cause is identified. The approach allows an iterative integration of detected faults such that the diagnosis of repeated faults is possible. The effectiveness of the approach and the iterative integration of faults is illustrated for the heat exchanger circuit of an air supply unit using real world measurement data.  
keywords: {Probability density function;Mutual information;Circuit faults;Kernel;Monitoring;Estimation;Silicon},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067215&isnumber=9067096>  
  
J. L. Wagner, M. Böhm and O. Sawodny, "Decentralized structural control using Craig-Bampton reduction and local controller design," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 41-46.  
doi: 10.1109/ICIT45562.2020.9067158  
Abstract: Large adaptive civil engineering structures are challenging to control due to widely distributed sensor and actuator locations and signal transmission delays. Furthermore, long bus systems and high effort in cable installation are disadvantageous and the dependance on one control unit poses security and safety risks. In this context, we propose a decentralized control scheme, where large structures are subdivided into local substructures, which can be controlled separately. Control design models derived by Craig-Bampton model order reduction preserve rigid-body modes and hence outperform reduced order models based on modal analysis. Linear optimal state-feedback controllers are designed for the substructures and applied the combined structure in simulations. The approach is illustrated by means of an adaptive high-rise structure as a numerical example. The performance is compared to a global state feedback controller.  
keywords: {Mathematical model;Decentralized control;Adaptation models;Actuators;Control design;Numerical models;Civil engineering;adaptive structure;decentralized control;sub-structuring;Craig-Bampton reduction},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067158&isnumber=9067096>  
  
J. K. Goyal et al., "Experimental Design of Robust Decentralized PI Controller for TRMS through Polytopic Modeling," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 47-52.  
doi: 10.1109/ICIT45562.2020.9067135  
Abstract: This paper presents a new approach to deal with the nonlinear dynamics present in a Twin Rotor MIMO System (TRMS) without any approximation of the system model. Conventionally, there are two approaches/options for adopting linear control design methods for a nonlinear system. The first one is to linearize the model around an operating point, neglecting the higher order dynamics. This could result in drastic changes in the transient behavior of the model for which the controller fails to ensure robustness and a good tracking response. The second approach is to consider the exact model and represent the nonlinear terms involved, in the form of structural or model uncertainties. The design technique adopted in this paper is based on the second approach. The nonlinear model of TRMS is represented in the form of a linear parameter-varying system, thereby facilitating the design of a linear robust controller, with a better tracking control of the desired states. Additionally, a robust Linear Matrix Inequality (LMI) based decentralized Proportional Integral (PI) controller is designed along with locating closed-loop poles in a desired region. A comparative study is done for experimental results of various existing designs and the proposed method.  
keywords: {Closed loop systems;Robust control;Linear matrix inequalities;PI control;Rotors;Control system synthesis;Decentralized control;Twin Rotor MIMO System;Linear matrix inequalities;Decentralized PI controller;Polytopic modeling},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067135&isnumber=9067096>  
  
Y. Triki, A. Bechouche, H. Seddiki and D. O. Abdeslam, "Improved D-Q Frame Controller for Stand-Alone Single-Phase Inverters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 53-58.  
doi: 10.1109/ICIT45562.2020.9067152  
Abstract: This paper develops an enhanced direct-quadrature (DQ) control strategy of single-phase voltage source inverter (VSI) for stand-alone distributed generation systems. As the proposal requires real and imaginary components, a new orthogonal signal generation (OSG) is designed to generate the imaginary component. The suggested OSG is based on an adaptive linear neuron. Since the proposal is not based on phase shift methods, it does not introduce any extra dynamics in the control loops. Moreover, in the developed strategy, the DQ scheme is justifiably simplified, making it easier to be implemented. The simplified DQ controller is evaluated through simulations using the average model. The proposed OSG is compared to the time delay- and second order all pass filter-based OSG methods. Obtained results concluded that the proposed strategy yields a simplified DQ controller with better performances.  
keywords: {Inverters;Voltage control;Steady-state;Mathematical model;Periodic structures;Proposals;Neurons;Adaptive linear neuron (ADALINE);DQ frame;orthogonal signal generation (OSG);single-phase DQ controller;voltage source inverter (VSI)},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067152&isnumber=9067096>  
  
F. Bravo-Montero, D. Castells-Rufas, S. A. Vogler and J. Carrabina, "Laser Inkless Eco-Printing on Paper and Cardboard," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 59-64.  
doi: 10.1109/ICIT45562.2020.9067267  
Abstract: We present a novel method to print paper and cardboard without ink. The method is based on the carbonization of paper by a combination of lasers working on different wavelengths. A prove of concept system is created based on combining existing commercial systems to demonstrate the viability of the method. The results show that no debris is generated and the quality of the mark is superior in terms of contrast and resolution with previously known methods.  
keywords: {Laser beams;Printing;Surface treatment;Surface emitting lasers;Color;Heating systems;Surface waves;Laser;Printing;Marking;Inkless},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067267&isnumber=9067096>  
  
R. Ramiro Peña, J. Ignacio Talpone, R. Mantz and P. Battaiotto, "MPPT for a photovoltaic system under partial shaded conditions," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 65-70.  
doi: 10.1109/ICIT45562.2020.9067180  
Abstract: In this paper, a method to find the maximum power point for a photovoltaic system under partial shaded conditions is presented. Furthermore, a control law using Passivity Based Control is proposed for a DC-DC converter. In addition, simulation results show the good performance of the extremum seeking control in searching the global maximum based in the inherent robustness of the Passivity Based Control.  
keywords: {Photovoltaic systems;Solar radiation;Search methods;IP networks;Photovoltaic cells;Integrated circuit modeling;mppt;renewable energy;solar energy;passivity based control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067180&isnumber=9067096>  
  
J. D. Valladolid, D. Paladines, J. Vidal and D. Patiño, "Proposal of Fuzzy Controllers for Improve Features of Driven Style in Electric Vehicles Using Experimental Route Data," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 77-82.  
doi: 10.1109/ICIT45562.2020.9067208  
Abstract: This document details the proposals of fuzzy controllers for improving the operating characteristics in electric vehicles (EV) through driving styles from experimental data. Fuzzy controllers were designed for following driving styles: aggressive, moderate and conservative; in order to improve the performance and comfort of the EV. For the acquisition of data, urban and extra-urban routes are used from the vehicle ECU through the On Board Diagnostics (OBD) II port. MATLAB simulations support the results obtained, indicating the performance of the proposed controllers, improving the performance and comfort of the EV, according to the selected driving style. Finally, statistical analysis is presented to quantitatively compare the results of the original and controlled signals.  
keywords: {Fuzzy logic;Input variables;Acceleration;Electric vehicles;Linguistics;Frequency control;Electric Vehicle;fuzzy controller;driving style;target tracking},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067208&isnumber=9067096>  
  
N. Oka and S. Katsura, "Sensorless Monitoring and Analysis of Grinding Process Using Disturbance Observer," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 83-88.  
doi: 10.1109/ICIT45562.2020.9067263  
Abstract: The automation of things has been further demanded due to various environmental changes such as declining birthrate, aging population, and declining labor force in recent years. Automation of processing is important in the manufacturing industry. The proposed servo grinder system is able to provide feedback to the servo motor based on various environmental conditions. Considering a nonlinear system that is strongly influenced by various environmental conditions, it can be extended to various machines, which will lead to further automation of things. In this paper, as an example of a non-linear system, coffee beans with various environmental parameters were the subject of the experiment, and an analysis was conducted for the purpose of building a grind model. As a result of the experiment, new properties of coffee beans were able to find. In the future, the accuracy of control of non-linear systems with various conditions will increase by analyzing the relationship between the processing conditions and particle size of coffee beans. It can also be applied to machine tool control by generalizing the constructed theory.  
keywords: {Powders;Blades;Servomotors;Angular velocity;Automation;Force;distribution;velocity control;position control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067263&isnumber=9067096>  
  
M. Nomura and T. Murakami, "Stable Traveling Control Considering Slip of Wheels in Two-wheel Mobile Robot," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 89-94.  
doi: 10.1109/ICIT45562.2020.9067225  
Abstract: Recently, two-wheel mobile robot such as Segway is expected to be applied to a personal mobility. And it has the advantage of easy turning and stepping over and the disadvantage that many sensors are required for stabilization. In conventional researches, the stability and operability of the two-wheeled mobile robot were improved. These are established by assuming that “the wheels do not slip”. However, a slip of the wheels cannot be ignored in actual driving, so that it is difficult to stably travel on a slippery road. In this paper, we consider the body-velocity by assuming “the wheels slip in the modeling”. Sliding mode control system by using the body-velocity was proposed. Then, the acceleration observer is introduced to compensate the acceleration on body velocity. We consider both the body-velocity tracking and the pitch angle stabilization and achieve stable traveling control on slippery road. The validity of the proposed method is confirmed by simulation results and experimental results.  
keywords: {Mobile robots;Wheels;Acceleration;Roads;Sliding mode control;Observers;Two-wheel mobile robot;Body-velocity tracking;Pitch angle stabilization;Sliding mode control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067225&isnumber=9067096>  
  
M. M. Morato, H. A. Pipino, E. Bernardi, D. M. Ferreyra, E. J. Adam and J. E. Normey-Rico, "Sub-optimal Linear Parameter Varying Model Predictive Control for Solar Collectors," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 95-100.  
doi: 10.1109/ICIT45562.2020.9067139  
Abstract: This short paper investigates the temperature control of a flat-plate water-heating solar collector. This nonlinear system is modelled via a quasi-linear parameter varying setting. To address this control problem, a model predictive control algorithm is formulated, considering a frozen guess for the evolution of the scheduling parameters, set-sequence constraints and a Lyapunov-decreasing terminal cost. The advantage of this method is that it uses standard quadratic programming problems and does not have to resort to nonlinear optimization. Through simulation, it is demonstrated that it can yield successful performances.  
keywords: {Computational modeling;Predictive control;Optimization;Prediction algorithms;Numerical models;Predictive models;Standards;Solar Collector;Model Predictive Control;quasi-Linear Parameter Varying Systems;Control invariant sets;Sub optimal},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067139&isnumber=9067096>  
  
K. Hirata, R. Murakawa, K. Okano, M. Samei, T. Adachi and R. Sugiyama, "Temperature Control for Fusing Process of Laser Printers with Preview Action," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 101-106.  
doi: 10.1109/ICIT45562.2020.9067239  
Abstract: In this paper, the temperature control of the fusing process of laser printers is considered. The central issue is how to determine the feedforward heater input along with the quick start-up strategy. The process is modeled to fit the preview control framework and the H∞ optimization is applied to obtain a controller. To overcome the modeling related problem that the preview signal (disturbance input) is not exogenous, a disturbance observer is introduced. The effectiveness of the proposed method is demonstrated though numerical simulations.  
keywords: {Heating systems;Feeds;Process control;Printing;Feedforward systems;Disturbance observers},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067239&isnumber=9067096>  
  
H. Wind, A. Renner, F. A. Bender and O. Sawodny, "Trajectory Generation for a Hydraulic Mini Excavator using Nonlinear Model Predictive Control," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 107-112.  
doi: 10.1109/ICIT45562.2020.9067227  
Abstract: Autonomous excavators have great potential to improve safety and to increase productivity. A common task for an excavator is to grade. Considering an autonomous grading system, a basic requirement is to perform straight line movements of the tool-center-point in the cartesian space. In this paper, a nonlinear model predictive controller is used to generate straight line trajectories of the tool-center-point considering actuator constraints. The performance is verified using a validated physical simulation model. The results show that the tool-center-point follows straight lines between the desired points without violating the constraints. Furthermore, the resulting trajectories are near time-optimal.  
keywords: {Trajectory;Actuators;Kinematics;Cost function;Indexes;Valves;Optimal control;automation systems;motion control;optimization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067227&isnumber=9067096>  
  
O. Veligorskyi, M. Khomenko, R. Chakirov and Y. Vagapov, "Variable Structure Controller for Plastic Injection Moulding System," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 113-118.  
doi: 10.1109/ICIT45562.2020.9067110  
Abstract: This paper discusses the approach to design of combined ANN and PID temperature controller for a plastic injection moulding system. The proposed method is based on integration of a conventional PID (PI) controller and a multilayer ANN. At the initial stage of operation, the ANN is trained in offline mode to approximately identify the dynamic parameters of the regulator optimised in terms of speed of response and overshoot. Under routine operation mode the ANN control structure is responsible for the fast transients whereas PID (PI) controller provides the high accuracy at the steady state condition. The paper focuses on the structure switching mechanism and the influence on the transient accuracy. In order to verify the proposed approach, the control system having various types of heaters has been modelled and simulated in Matlab/Simulink. The data obtained from the experiment verified the developed model and confirmed the results of simulations.  
keywords: {Switches;Heating systems;Plastics;Mathematical model;Transfer functions;plastic industry;melting heater;ANN;PID;temperature controller},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067110&isnumber=9067096>  
  
K. Ohta et al., "Variable Switching Frequency Control for Efficiency Improvement of Motor Drive System by Using GaN Three Phase Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 119-123.  
doi: 10.1109/ICIT45562.2020.9067266  
Abstract: This paper aims to propose a new traction motor control system for electric vehicles (EVs). EVs are required to have higher energy efficiency in motor control systems for cruising longer distance. However, motor control systems, which are generally equipped with Si-IGBT inverters, have limits of the energy efficiency. Therefore, new inverters, which use wide bandgap (WBG) semiconductor devices such as Gallium Nitride (GaN), are expected to be a solution to improve the energy efficiency. Having less energy loss in conducting and switching operation than Si-IGBT inverters, the GaN inverters can increase the switching frequency. In addition, the reduction of harmonic loss of the motors will enable us to improve the energy efficiencies of the entire motor control system. Although previous researches have demonstrated the performance of various inverters, the experiments demonstrated only inverters of small capacities that are insufficient to be applied in traction motor control of EVs. Then, our research group are challenging to increase the power of GaN inverters and to realize their practical application to compact EVs. In this research, the switching frequency of the GaN inverter was dynamically changed to verify the higher energy efficiency of the motor control system. The results of the experiment have shown that the total energy efficiency can be improved by up to about 1.5% and the total loss can be reduced by up to about 10%.  
keywords: {Inverters;Gallium nitride;Switching frequency;Traction motors;Motor drives;Torque;Control systems;Wide bandgap;GaN;inverter;PMSM;Electric Vechicles},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067266&isnumber=9067096>  
  
"EMD - Electrical Machines and Drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 124-126.  
doi: 10.1109/ICIT45562.2020.9067151  
Abstract: Start of the above-titled section of the conference proceedings record.  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067151&isnumber=9067096>  
  
P. Kumar, D. V. Bhaskar, R. K. Behera and U. R. Muduli, "A Modified Torque Ripple Minimization Technique for BLDC Motor Drive using Synthesized Current Phase Compensation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 127-132.  
doi: 10.1109/ICIT45562.2020.9067134  
Abstract: This paper proposes a novel technique of torque ripple minimization of brushless dc motor. The stator current has been synthesised based on sector selection and a novel switching technique by modifying the three phase supply currents of the BLDC motor drive. The trajectory of the modified current vector has been determined by vector approach in stationary plane. The commutation judgement determines the normal conduction period and commutation period by tracking the mode of operation according to the speed. Based on this analysis, the calculated optimal phase angle compensates the current commutation error. The performance of the proposed drive with phase compensation of synthesized currents ensures to minimize the torque ripple. The effectiveness of proposed strategy is validated by experimental results.  
keywords: {Torque;Commutation;Torque measurement;Motor drives;Stators;Trajectory;Electromagnetics;Brushless DC motor drive;synthesized current supply;commutation judgement;vector current control;torque ripple minimization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067134&isnumber=9067096>  
  
E. M. Merouane, C. Escudero, F. Sicard and E. Zamai, "Aging Attacks against Electro-Mechanical Actuators from Control Signal Manipulation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 133-138.  
doi: 10.1109/ICIT45562.2020.9067147  
Abstract: The progress made in terms of controller technologies with the introduction of remotely-accessibility capacity in the digital controllers has opened the door to new cybersecurity threats on the Industrial Control Systems (ICSs). Among them, some aim at damaging the ICS's physical system. In this paper, a corrupted controller emitting a non-legitimate Pulse Width Modulation control signal to an Electro-Mechanical Actuator (EMA) is considered. The attacker's capabilities for accelerating the EMA's aging by inducing Partial Discharges (PDs) are investigated. A simplified model is considered for highlighting the influence of the carrier frequency of the control signal over the amplitude and the repetition of the PDs involved in the EMA's aging.  
keywords: {Partial discharges;Aging;Pulse width modulation;Degradation;Actuators;Cavity resonators;Harmonic analysis;Cybersecurity;Security;Aging Attacks;Digital controller;Partial Discharges;Industrial Control Systems},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067147&isnumber=9067096>  
  
Y. Hu et al., "Bidirectional Coupling Calculation of Electromagnetic Field and Thermal Field for FSPM Machine," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 139-144.  
doi: 10.1109/ICIT45562.2020.9067171  
Abstract: In this paper, the bidirectional coupling analysis between the magnetic field and thermal field is proposed. The key point is how to find the coupling mechanism between the two fields. Firstly, the accurate iron loss model considering the dc magnetic bias is build based on the Epstein frame, where the effect of temperature on the iron loss is also considered. Then, the detailed calculation process of the bidirectional coupling analysis is given. At last, the 12/10 flux switching permanent magnet (FSPM) machine is investigated. The results of magnetic losses obtained by the bidirectional coupling analysis and uncoupled analysis are obvious different. And the results of temperature in different components of FSPM machine obtained by the coupling analysis is higher than that obtained by the uncoupled analysis.  
keywords: {Iron;Temperature measurement;Magnetic hysteresis;Magnetic flux;Couplings;Loss measurement;Frequency measurement;Electromagnetic-thermal field coupling;FSPM machine;loss calculation;thermal analysis},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067171&isnumber=9067096>  
  
L. Delorme, M. Ayala, J. Rodas, R. Gregor, O. Gonzalez and J. Doval-Gandoy, "Comparison of the Effects on Stator Currents Between Continuous Model and Discrete Model of the Three-phase Induction Motor in the Presence of Electrical Parameter Variations," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 151-156.  
doi: 10.1109/ICIT45562.2020.9067265  
Abstract: Three-phase induction motors are the most widely used electrical energy conversion machines due to their low cost, robustness, and ease of maintenance. Hence, the mathematical model analysis is fundamental to comprehend the behavior of the machine in order to implement a certain type of control. This article presents a comparison between the effects on the current, in steady-state, of electrical parameter variations of a three-phase induction motor model based on discrete-time with a continuous model by considering electrical parameters fixed in nominal values. Side by side comparisons between the application of pure sinusoidal waveforms and PWM waveforms generated by a voltage source inverter to the induction motor are presented. Simulation results are provided to show the parameter with the most significant impact over the machine when varying values.  
keywords: {Mathematical model;Stators;Rotors;Analytical models;Steady-state;Inverters;Induction motors;Induction motors;magnetization inductance;predictive discretized model},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067265&isnumber=9067096>  
  
S. Xia and S. Wang, "Design of High-speed High Power Density Single-phase Permanent Magnet Brushless DC Motor Considering Control Performance," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 157-162.  
doi: 10.1109/ICIT45562.2020.9067127  
Abstract: This paper points out that asymmetric air gap cause phase shift of cogging torque and electromotive force (EMF), which will affect motor performance. The method of adding phase compensation in control is proposed. In addition, a new structure of asymmetric air gap that can reduce torque ripple is proposed and used in design of high speed high power density single-phase permanent magnet brushless direct current (SPPMBLDC) motor. To reduce the stator iron loss and rotor eddy current loss caused by high frequency harmonics, 0.1 mm thick ultra-thin electrical steel sheet for the state core is used and the motor with sinusoidal EMF is designed. Finally, a 500 W, 100 000 r/min SPPMBLDC motor is designed and verified by finite element method. And the power density of this motor is calculated to be 32.15 kW/L (37.59 kW/kg).  
keywords: {cogging torque;EMF;high power density;high speed;phase shift},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067127&isnumber=9067096>  
  
N. Yogal, C. Lehrmann and M. Henke, "Experimental measurement of eddy current loss in permanent magnets of electrical machines with a PWM signal generated by a frequency converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 163-168.  
doi: 10.1109/ICIT45562.2020.9067204  
Abstract: In today's highly automated world, permanent magnet synchronous machines (PMSMs), commonly used in the industrial automation of traction, robotics or aerospace, require higher power density and efficiency. When developing such PMSMs, the eddy current loss (i.e. permanent magnet loss) in the permanent magnets (PMs), especially with respect to temperature and frequency influence, must be considered. The increase in the temperature of PMs above the allowed maximum temperature leads to a tendency towards irreversible demagnetization and changes in the electrical conductivity of the material. Similarly, higher harmonics with different frequencies influence the eddy current loss of the PMs. The accurate analytical analysis and measurement methods of PM loss can help PMSM designers to create robust PMSMs with high tolerances and higher energy efficiency at low manufacturing costs. In this paper, measurement methods and a finite element method (FEM) simulation for the PM loss of PMSMs are presented and compared. In addition, we consider the eddy current loss (i.e. PM loss) in PMs, which are under external magnetic fields generated with a sinusoidal or non-sinusoidal pulse width modulation (PWM) signal under higher frequency effects.  
keywords: {Eddy currents;loss measurement;permanent magnets;permanent magnet synchronous machines;rare earth metals},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067204&isnumber=9067096>  
  
V. M. R. de Oliveira, R. S. Camargo and L. F. Encarnação, "Field Oriented Predictive Current Control on NPC Driving an Induction Motor," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 169-174.  
doi: 10.1109/ICIT45562.2020.9067236  
Abstract: This paper proposes a predictive current control (PCC) strategy with a field orientation applied on a three-level neutral point clamped (NPC) inverter to drive a three-phase induction motor. It was used the optimal switching vector (OSV) strategy, which is most suitable for power electronics. The field orientation, along with a rotor flux estimation, made it possible to implement a control loop measuring only stator voltage, stator current and rotor speed. The simulation results showed that the average estimated rotor flux error was 0.03%, the total harmonic distortion (THD) for the stator current was 9.29%, and the average stator current error was 5.82%. The proposed model proved to be a viable option to industrial plants, especially when compared with classical controllers.  
keywords: {Predictive Current Control (PCC);Neutral Point Clamped (NPC);Multilevel Converters;Field Orientation;Induction Motor},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067236&isnumber=9067096>  
  
B. Tian, M. Molinas, S. Moen and Q. An, "High dynamic speed control of the Subsea Smart Electrical Actuator for a Gas Production System," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 175-180.  
doi: 10.1109/ICIT45562.2020.9067282  
Abstract: The next revolution of the subsea gas production system is the replacement of traditional hydraulic devices with all-electronic ones. The hydraulics and spring system that is typically used to close the valve in an emergency is gradually abandoned, and as one of the promising candidates, the smart electrical actuator has attained tremendous attention. The utilization of high-efficient permanent magnet synchronous motor (PMSM) provides more flexibilities and faster response in operating the valve and therefore is much preferred in this application. This paper proposes a high dynamic speed control strategy for subsea smart electrical actuators (SMAs), which comprises a direct torque control for the inner loop and a sliding mode control (SMC)-based speed regulator in the outer loop. In a combination of these two techniques, the system dynamics can be remarkably improved. A comparative study between the proposed SMC and the previous methods, including the classical PI controller and the former SMC, is carried out through the simulation, where the advantages of the presented method are confirmed.  
keywords: {Smart electrical actuator;Direct torque control;Sliding mode control;Gas production system},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067282&isnumber=9067096>  
  
Y. Yamada, T. Nozaki and T. Murakami, "Independent Drive of Multiple AC Motors Using Amplitude Modulation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 181-186.  
doi: 10.1109/ICIT45562.2020.9067275  
Abstract: With the recent development of electric drive technology, systems with multiple electric motors are increasingly used in various applications. Among them, methods of driving multiple electric motors by using only one power source is studied. This multi-motor drive system contributes to the reduction of the number of power supplies and electric parts. Because of these characteristics, the system is effective in reducing the weight and the size of whole system. Therefore, this paper proposes a circuit that can control motors by frequency separation using the principle of amplitude modulation. As a result, it is possible to drive a plurality of motors independently and simultaneously with only one power supply. The simulations of multiple motor drives by the proposed circuit was conducted.  
keywords: {Inverters;Band-pass filters;Synchronous motors;Load modeling;Induction motors;Permanent magnet motors;IPMSM;motion control;parallel motor drives},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067275&isnumber=9067096>  
  
M. Carbonieri and N. Bianchi, "Induction Motor Rotor Losses Analysis Methods Using Finite Element," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 187-192.  
doi: 10.1109/ICIT45562.2020.9067209  
Abstract: In this paper, an analysis procedure for the induction motor rotor losses evaluation is presented. The technique uses only magneto-static and linear time-harmonic simulations, avoiding the time-domain approach. The rotor losses, analyzed in this paper, are due to stator slot harmonics. This kind of losses take place in both the rotor iron and, as Joule losses, in the cage. The iron losses are due to high frequency flux pulsation, thus they can be serious and not negligible, specially during high speed and frequency operation. A fast analysis technique is implemented to evaluate the rotor losses, due to the stator space harmonics,. avoiding the long time-domain approach. The analysis is done carefully taking into consideration the saturation effect and the different rotor cage reaction, in presence or not of the rotor skewing, is considered too.  
keywords: {Rotors;Harmonic analysis;Iron;Stator windings;Induction motors;Air gaps;Induction Machines;finite element analysis;skewing;cage rotor;analysis;modeling},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067209&isnumber=9067096>  
  
E. Armando, A. Boglietti, S. Musumeci, S. Rubino, E. Carpaneto and D. Martinello, "Measurement Technique for the Permanent Magnet Rotor Thermal Time Constant Determination," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 193-198.  
doi: 10.1109/ICIT45562.2020.9067271  
Abstract: In this paper, an innovative measurement technique that allows the determination of the permanent magnet thermal time constant of permanent magnet synchronous machines is proposed. The novelty of the proposed procedure consists of the determination of the permanent magnet thermal time constant without the test being influenced by the other rotor parts such as lamination, shaft, etc. Therefore, it can be applied to any permanent magnet synchronous machine type, assuming general validity. The proposed experimental setup consists of controlling the currents of the machine under test while an external electric drive sets its speed. Experimental results for two permanent magnet synchronous machine types are presented, demonstrating the feasibility of the proposed procedure.  
keywords: {Stator windings;Couplings;Voltage measurement;Resistance;Current measurement;Electrical resistance measurement;Heating systems;thermal time constant;permanent magnet synchronous machines;thermal analysis},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067271&isnumber=9067096>  
  
J. Bae, K. Cho and D. -H. Lee, "Parallel Position Control Scheme of Permanent Magnet DC Motors with a Low-Resolution Sensor," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 199-204.  
doi: 10.1109/ICIT45562.2020.9067269  
Abstract: This paper presents a parallel position control of two DC motors simultaneously with a low-resolution hall sensor. To achieve the balanced position control of the geared brushed DC motors, accurate speed and position controls are required. In order to improve the position control performance of the system, a current model speed observer and the back EMF constant adaptive system are implemented in this paper. Using the back EMF estimation and the current model speed observer, the continuous and accurate speed and position can be estimated. The back EMF constant to estimate the DC motor speed is adjusted using the average speed error between the speed observer and the actual speed obtained with the low-resolution hall sensor. The compensation of the position error between the two DC motors can be done using the instantaneous position compensator in the proposed control scheme. The control performance of the dual DC motor system was tested by MATLAB simulation and practical experiments with the manufactured test bench. In the simulation and experiments, the proposed position control scheme shows the improved control performance compared to the conventional control method.  
keywords: {Position control;Observers;Mathematical model;Brushless DC motors;Permanent magnet motors;Permanent magnet DC motor;Sensorless control;Low-resolution sensor;Speed and position control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067269&isnumber=9067096>  
  
J. Rengifo, F. Vaca and J. M. Aller, "Instantaneous input impedance method for PMSM parameter estimation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 205-210.  
doi: 10.1109/ICIT45562.2020.9067126  
Abstract: This paper presents a parameter estimation method for a permanent magnet synchronous machine (PMSM) based on the instantaneous input impedance, which is defined as a function of the instantaneous voltage and current space vectors fixed to the rotor reference frame. The parameters are calculated solving the nonlinear optimization problem to minimize the difference between the estimated and measured input voltages. This problem was solved using Interior-Points, and Genetic Algorithm (GA) to compare the computing time required in each case. The parameter estimation method was evaluated using data obtained from a co-simulation between ANSYS RMxprt-Simplorer® and MATLAB-SIMULINK® in a PMSM drive application using conventional Field Oriented Control (FOC) approach. The results prove the method capability to estimate the direct and quadrature self-inductances, and the magnet flux. Also, the stator a reasonable value of the stator resistance can be estimated. Finally, the paper presents an additional simulation of the PMSM using the estimated parameters, and the outcomes have a good correspondence with those obtained from the co-simulation.  
keywords: {Parameter estimation;Finite element analysis;Torque;Rotors;Stators;Optimization;Mathematical model;permanent magnet synchronous machine;parameter estimation;transient measurement;nonlinear optimization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067126&isnumber=9067096>  
  
J. A. Riveros, M. Rivera, C. Rodríguez, M. Galea, G. Buticchi and P. Wheeler, "Predictive Torque Control with Fixed Switching Frequency for Induction Motor Drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 211-216.  
doi: 10.1109/ICIT45562.2020.9067232  
Abstract: Predictive torque control is one of the most considered high-performance methods for variable-speed applications. This scheme is characterised by a flexible architecture that provides a fast torque/flux response, while its operation reports variable switching frequency as one of the main issues. This work presents a redesigned technique to overcome the described drawback. The strategy applies two active voltage space vectors with an appropriate sequence at every sampling period to produce a constant number of commutations. The dwell times are computed with the conventional cost function and a novel optimisation process to obtain the proper switching combination. Simulation tests at transient- and steady-state demonstrate the quick dynamic response of this proposal, whereas a performance comparison respect to the conventional implementation illustrates the achieved enhancements and mitigation trade-off.  
keywords: {Switches;Stators;Cost function;Switching frequency;Torque;Predictive models;Predictive control;torque control;variable speed drives},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067232&isnumber=9067096>  
  
C. Jung, C. R. Claure Torrico and E. G. Carati, "Reactive power based MRAC for robustness and efficiency improvements on a IFOC induction motor drive," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 217-222.  
doi: 10.1109/ICIT45562.2020.9067318  
Abstract: Indirect Field Oriented Control (IFOC) provides to the Three-phase Induction Motor (TIM) a great dynamic response, which is a solution widely employed in the industry. However, this technique is sensible to variations in the rotor bandwidth parameter and, due to temperature and saturation effects, this coefficient changes during operation degrading the overall response of the system. In this work, an indirect Model Reference Adaptive Control (MRAC) based on the TIM reactive power model it is used to adapt this parameter value in real-time during motor operation. Moreover, a Loss Model based Control (LMC) is introduced with the purpose to reduce the system power losses. The strategy proposed here increases the efficiency and robustness of the control system, maintaining the good dynamic response even with the variations of the rotor bandwidth parameter.  
keywords: {Rotors;Bandwidth;Adaptation models;Torque;Induction motors;Reactive power;Stators;Induction motor drive;field oriented control;MRAC;LMC;reactive power;efficiency;robustness},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067318&isnumber=9067096>  
  
P. M. de la Barrera, G. R. Bossio, S. Hieke and R. Leidhold, "SynRM saliencies evaluation for rotor position estimation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 223-229.  
doi: 10.1109/ICIT45562.2020.9067106  
Abstract: The evaluation of the SynRM saliencies for rotor position estimation using a high-frequency zero sequence signal (ZSS) injection strategy is presented in this paper. The strategy injects a ZSS and evaluates its response in the α-β component. This ZSS does not interact with the current control and the evaluation of its response is simple, nevertheless, it requires access to the neutral point of the machine. Experimental results show that the used auxiliary signal have the information of the SynRM saliencies and that it is possible to estimate rotor position with it. Also, new error compensation methods should be studied in order to improve the well-known rotor position estimation method based on the arctangent.  
keywords: {Rotors;Estimation;Torque;Stators;Standards;Inverters;Current measurement;SynRM;ZSS injection strategy;rotor position estimation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067106&isnumber=9067096>  
  
S. Ruzbehi and I. Hahn, "Two-level Topology Optimization of an Electromagnetic Actuator Based on Genetic Algorithm and Neighbourhood Method," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 230-233.  
doi: 10.1109/ICIT45562.2020.9067305  
Abstract: In this paper a multi-objective topology optimization method is presented to find an innovative design and to improve the conventional iron core structures, which are used in rotary electrical machines and electromagnetic devices. The goals are to find an optimal material distribution with less material usage, which makes the device lighter, and also considering the magnetic force to remain in a reasonable range. At first, a meta-heuristic method, called Enhanced Binary Genetic Algorithm (EBGA) is used to gain an optimal material distribution. In the next step, as a post-processing task, a Neighborhood method is used to improve the technical results, to remove the voids inside the iron shape and to make the structure more suitable for the manufacturing process according to the nowadays available manufacturing technologies. This method is inspired by the image processing technique. Afterwards, a third type of material (copper) is added to the design domain. Air cells, which surround some parts of the copper coil area, will be replaced by copper. With these three steps the amount of force increases significantly, while a lighter optimal shape is obtained. As a case study, the proposed method is tested on a simple electromagnetic nonlinear actuator. The results of this work show that it is possible to extend the method to different active parts of electrical machines such as permanent magnet, stator and rotor.  
keywords: {Multi-level optimization;Neighborhood method;Magnetic actuator;Topology optimization;Genetic algorithm},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067305&isnumber=9067096>  
  
"ESOC Electronic Systems-on-Chip and Embedded Systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 234-236.  
doi: 10.1109/ICIT45562.2020.9067197  
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R. Fife, I. Udoh and P. Garcia, "Coherency overhead of Processing-in-Memory in the presence of shared data," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 237-242.  
doi: 10.1109/ICIT45562.2020.9067234  
Abstract: Processing-in-Memory (PIM) architectures are an instance of Near-Data Processing (NDP) that promise to bridge the power-and performance-walls caused by the high latency and power costs associated with external memory access. PIM systems can minimize data transfers to and from processor/memory, relegating (parts of) processing to memory. However, the effects of processor (s)/PIM-systems shared access to data on coherency overhead are not yet understood. In this manuscript, we model coherency overhead of shared data access by processor and PIM systems: i.e., shared access to common data. We present an analytical model that quantifies performance in function of degree of interleaving and PIM system latencies. We evaluate our model using simple image processing kernels, and experimentally validate our approach using PIMSIM, an open-source PIM simulator. Results show that our analytical model can predict coherency overhead within 2% of error margin, and we identify several interesting behaviors that warrant further research towards widespread adoption of PIM.  
keywords: {Mathematical model;Data models;Analytical models;Random access memory;Computational modeling;Image processing;Computer architecture;Processing In Memory (PIM);coherency;performance;accelerators},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067234&isnumber=9067096>  
  
A. Bucaioni and S. Mubeen, "MoVES Meets the Real World Automotive Benchmarks," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 243-248.  
doi: 10.1109/ICIT45562.2020.9067182  
Abstract: This paper presents a model-driven development methodology for automotive real-time embedded systems that is augmented according to realistic but intellectual property free automotive benchmarks. The augmentation correspond to the enrichment of various real-time properties and design decisions in the methodology, including the specification of different activation rates and patterns along embedded software component chains. These chains can be deployed within Electronic Control Units as well as on multiple distributed Electronic Control Units connected by on-board networks. This is achieved by extending the modelling language pillar of the methodology with structural elements and constraints guiding the specification of the activation rates and enforcing the activation patterns in the chains. The proposed extensions automatically discard non-complying activation rates along the chains and aid the engineer to select valid activation rates according to the automotive benchmarks. The extended methodology reduces the complexity of software development in automotive real-time embedded systems.  
keywords: {Automotive engineering;Benchmark testing;Embedded systems;Embedded software;Computational modeling;Unified modeling language},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067182&isnumber=9067096>  
  
"IACNI - Industrial Automation, Communication, Networking and Informatics," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 249-250.  
doi: 10.1109/ICIT45562.2020.9067324  
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R. Candell, M. Kashef, Y. Liu, K. Montgomery and S. Foufou, "A Graph Database Approach to Wireless IIoT Workcell Performance Evaluation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 251-258.  
doi: 10.1109/ICIT45562.2020.9067199  
Abstract: The workcell is considered a main building block of various industrial settings. Hence, it is examined as a primary testing environment for studying wireless communication techniques in factory automation processes. A new testbed was recently designed and developed to facilitate such studies in workcells by replicating various data flows in an emulated production environment. In this paper, an approach to storing and analyzing network performance data from a manufacturing factory workcell is introduced. A robotic testbed was constructed using two collaborative grade robot arms, machine emulators, and wireless communication devices. A graph database approach was implemented to capture network and operational event data among the components within the testbed. A schema is proposed, developed, and elaborated; a database is then populated with events from the testbed, and the resulting graph is presented. Query commands are then presented as a means to examine and analyze network performance and relationships within the components of the network. Additionally, we demonstrate how to extract correlations between receive signal power and network delay within the testbed using the graph database query language. Finally, using the inherently interconnected nature of the graph database, we discuss applying the graph database approach toward examining more complex relationships between the wireless communications network and the operational system.  
keywords: {Wireless communication;Production facilities;Robot sensing systems;Protocols;Distributed databases;industrial wireless;factory automation;testbed;measurement;instrumentation;graph database},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067199&isnumber=9067096>  
  
P. Branch and T. Cricenti, "A LoRa Relay Based System for Detonating Explosives in Underground Mines," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 259-264.  
doi: 10.1109/ICIT45562.2020.9067213  
Abstract: In this paper we present our work on the use of LoRa as a network technology for detonation of low explosives in underground mining. Using explosives underground is a potentially hazardous activity that mining companies are keen to make safer by removing personnel from near the site of the detonation. Currently detonation is commonly carried out using lengths of copper cable or infrared transmission, both of which limit the distance between the initiator and the explosives. The wireless technology LoRa, is an attractive alternative. LoRa has a much longer transmission range than infrared transmission and other wireless technologies such as WiFi and ZigBee. We have developed and trialed in a working underground mine a prototype system for carrying out such detonations. The system makes use of LoRa as a multi-hop message passing system from an Initiator to a Detonator via a number of Relays. We describe the messages that are passed through the network. We also describe how we deal with contention, broadcast storms and duplicate messages. Our approach is robust, easy to deploy and gives deterministic delay. We also present measurements of signal strength taken underground. Our results indicate that underground LoRa wireless transmission suffers severe fading without line of sight but where this is a line of sight underground, we show that LoRa propagates considerable distances.  
keywords: {Explosives;Wireless communication;Delays;Wireless sensor networks;Relay networks (telecommunications);Actuators;LoRa;Industrial Internet},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067213&isnumber=9067096>  
  
H. Qiao, J. O. Blech and H. Chen, "A Machine learning based intrusion detection approach for industrial networks," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 265-270.  
doi: 10.1109/ICIT45562.2020.9067253  
Abstract: Industry 4.0 and Industrial Internet of Things (IIoT) are current trends in the industrial automation world. They require connections of factory networks to the internet. This trend increases the vulnerability of factory networks to attacks. Here, we present an approach that monitors the activities of factory network traffic based on two linear feature extraction algorithms, i.e. LDA and PCA. A Machine-Learning-based approach is used to analyze the records of network connections from the UNSW-NB15 database and to detect and report anomalies such as malicious attacks. The experimental results show the feasibility of the provided method in accuracy, detection rate, and false alarm rate.  
keywords: {Feature extraction;Principal component analysis;Training;Testing;Machine learning;Databases;Computer security},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067253&isnumber=9067096>  
  
U. D. Atmojo, J. O. Blech and V. Vyatkin, "A Plug and Produce-inspired Approach in Distributed Control Architecture: A Flexible Assembly Line and Product Centric Control Example," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 271-277.  
doi: 10.1109/ICIT45562.2020.9067278  
Abstract: There is an increasing trend of manufacturing new products in small lot sizes even though their specifications may not be known before the order actually arrives. This requires a high level of agility and in particular support on the software side. Thus, dynamic reconfiguration of controllers and appropriate communication paradigms that can adapt to the changing infrastructure on the factory floor are desirable. This paper presents work towards introducing a plug and produce-style approach, a paradigm where devices can be dynamically added, removed, or reconfigured on the factory floor. Our example is based on OPC UA on an assembly line with an IEC 61499-based environment to introduce flexibility, interoperability, and fault tolerance.  
keywords: {Plugs;Software;Production facilities;IEC Standards;Robots;Computer architecture;plug and produce;distributed;product-centric control;OPC UA;service-oriented architecture;IEC 61499;flexibility},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067278&isnumber=9067096>  
  
S. Cavalieri, S. Mulè and M. G. Salafia, "Enabling OPC UA and oneM2M Interworking," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 278-285.  
doi: 10.1109/ICIT45562.2020.9067161  
Abstract: Industry 4.0 features the application of modern Information & Communication Technology concepts in industrial contexts to create more flexible and innovative products and services leading to new added-value business models. Realization of this fourth industrial revolution may be achieved only if enough effort is invested to introduce interoperability between industrial applications. For this reason, current literature presents a lot of proposals aimed to improve interoperability between reference communication standards of Industry 4.0. Among them, several research activities aim to reach this goal by proposing interworking solutions between standard communication systems. Although OPC UA and oneM2M play very important roles inside Industry 4.0, interworking between them is not available at this moment. For this reason, the paper aims to propose a novel solution towards OPC UA and oneM2M interworking.  
keywords: {Industries;Standards;Interoperability;Manganese;Data models;Keywords-OPC UA;oneM2M;Interworking;Industry 4.0},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067161&isnumber=9067096>  
  
F. Arévalo, D. Sunaringtyas, C. Tito, C. Piolo and A. Schwung, "Interactive Visual Procedure using an extended FMEA and Mixed-Reality," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 286-291.  
doi: 10.1109/ICIT45562.2020.9067296  
Abstract: In this paper, an application is created for the HoloLens, a headgear that enables users to experience mixed reality. The application proves that it is plausible to create an interactive visual guide in the form of a Unity application, in order to support operators with the fault detection assessment of a machine. This application utilizes WorldAnchors and a Vuforia engine to fix the holograms spatially. It shows the steps to solve detected faults through holograms and CAD models. The troubleshooting steps are modelled using an extended Failure Mode and Effects Analysis (FMEA) as a knowledge extraction method. This method extracts expert knowledge from the operators in a systematic way, as well as it maps the faults with the current feed of the machine data. Users can interact with buttons through the guide on the HoloLens until the fault is solved. The fault detection system is located in a software framework, which collects data from the machine using the OPC-UA communication protocol. This system is proven to be useful, as well as it has a low latency of 51 ms.  
keywords: {Tools;Visualization;Solid modeling;Feature extraction;Software;Augmented reality;Mixed Reality;Fault Assessment;extended FMEA;HoloLens;OPC-UA;MQTT},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067296&isnumber=9067096>  
  
G. Vieira, J. Barbosa, P. Leitão and L. Sakurada, "Low-Cost Industrial Controller based on the Raspberry Pi Platform," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 292-297.  
doi: 10.1109/ICIT45562.2020.9067148  
Abstract: Programmable Logic Controllers (PLCs) still are the state-of-the-art regarding the industrial automation control, but the Industry 4.0 advent is imposing new requirements, e.g., related to the capability to acquire and process data on realtime at the edge computational layer. On the other hand, the current availability of cheaper and more powerful processors opens new windows to develop low-cost and more advanced industrial controllers aligned with the Industry 4.0 principles. In this context, an important challenge is to improve the current state-of-the-art PLCs by taking into consideration the low-cost but powerful computational boards that will allow to embed IoT technologies and data analytics. This work describes the development of a low-cost but powerful industrial controller based on the use of the single-board computer Raspberry Pi, which allows executing logic control programs codified in IEC 61131–3, IEC 61499, or even in Java or Python, while maintaining the industrial requirements. The proposed platform was experimentally used to control an automation process based on a Fischertechniks platform.  
keywords: {IEC Standards;Automation;Hardware;Computer languages;Open source software;Programming environments;Industries;Cyber-Physical Systems;Industrial automation;Industrial Internet of Things;Programmable Logic Controller},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067148&isnumber=9067096>  
  
D. Hellmanns, J. Falk, A. Glavackij, R. Hummen, S. Kehrer and F. Dürr, "On the Performance of Stream-based, Class-based Time-aware Shaping and Frame Preemption in TSN," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 298-303.  
doi: 10.1109/ICIT45562.2020.9067122  
Abstract: Time-sensitive Networking (TSN) is an evolving group of IEEE standards for deterministic real-time communication making standard Ethernet technology applicable to safety-critical application domains such as manufacturing or automotive systems. TSN includes several mechanisms influencing the timely forwarding of traffic, in particular, a time-triggered scheduling mechanism called time-aware shaper (TAS) and frame preemption to reduce the blocking time of high-priority traffic by low-priority traffic. Although these mechanisms have been standardized and products implementing them begin to enter the market, it is still hard for practitioners to select and apply suitable mechanisms fitting the problem at hand. For instance, TAS schedules can be calculated for individual streams or classes of traffic, and frame preemption with strict priority scheduling (w/o TAS) might seem to be an option in networks with extremely high data rates. In this paper, we make a first step towards assisting practitioners in making an informed decision when choosing between stream-based TAS, class-based TAS, and frame preemption by comparing these mechanisms in selected scenarios using our TSN network simulation tool NeSTiNg. Moreover, to facilitate the application of class-based TAS, we derive a formula for calculating class-based TAS configuration.  
keywords: {Delays;Switches;Job shop scheduling;Logic gates;IEEE Standards;Schedules;Jitter;real-time communication;time-sensitive networking;TSN;scheduling;frame preemption},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067122&isnumber=9067096>  
  
E. Sallum, N. Pereira, M. Alves and M. Santos, "Performance optimization on LoRa networks through assigning radio parameters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 304-309.  
doi: 10.1109/ICIT45562.2020.9067310  
Abstract: Low Power Wide Area Networks (LPWAN) enable a growing number of Internet-of-Things (IoT) applications with large geographical coverage, low bit-rate, and long lifetime requirements. LoRa (Long Range) is a well-known LPWAN technology that uses a proprietary Chirp Spread Spectrum (CSS) physical layer, while the upper layers are defined by an open standard - LoRaWAN. In this paper, we propose a simple yet effective method to improve the Quality-of-Service (QoS) of LoRa networks by fine-tuning specific radio parameters. Through a Mixed Integer Linear Programming (MILP) problem formulation, we find optimal settings for the Spreading Factor (SF) and Carrier Frequency (CF) radio parameters, considering the network traffic specifications as a whole, to improve the Data Extraction Rate (DER) and to reduce the packet collision rate and the energy consumption in LoRa networks. The effectiveness of the optimization procedure is demonstrated by simulations, using LoRaSim for different network scales. In relation to the traditional LoRa radio parameter assignment policies, our solution leads to an average increase of 6% in DER, and a number of collisions 13 times smaller. In comparison to networks with dynamic radio parameter assignment policies, there is an increase of 5% and 2% of DER, and a number of collisions 11 and 2.5 times smaller than equal-distribution, and random distribution, respectively.  
keywords: {Optimization;Logic gates;Payloads;Cascading style sheets;Physical layer;Standards;Mixed integer linear programming;Internet of Things (IoT);Low-Power Wide Area Network (LPWAN);Mixed Integer Linear Programming (MILP);LoRaWAN;LoRa Simulator (LoRaSim);Optimization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067310&isnumber=9067096>  
  
A. Beaudet, F. Sicard, C. Escudero and E. Zamaï, "Process-Aware Model-based Intrusion Detection System on Filtering Approach: Further Investigations," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 310-315.  
doi: 10.1109/ICIT45562.2020.9067195  
Abstract: Against new emerging cyber-threats targeting Industrial Control Systems (ICSs), Intrusion Detection Systems (IDSs) have emerged as viable solutions for implementing signature or behavioural approaches. The Security Approach based on Filter Execution (S.A.F.E.), a process-aware model-based IDS, deploys detection mechanisms through the implementation of command and report filters close to the process under control. Based on the S.A.F.E. approach, this paper proposes its improvement and novel contributions: a report filter modelling, optimization algorithms for speeding up the computation of the detection indicators and an implementation on a real testbed.  
keywords: {Integrated circuits;Process control;Intrusion detection;Computational modeling;Filtering algorithms;Actuators;Cybersecurity;Industrial Control System;Discrete-Event System;Process-aware Model-based Detection;Intrusion Detection Indicators;Intrusions Detection Systems},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067195&isnumber=9067096>  
  
L. Zhu, J. Chen and C. -I. Chen, "Prognostics of tool failing behavior based on autoassociative Gaussian process regression for semiconductor manufacturing," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 316-321.  
doi: 10.1109/ICIT45562.2020.9067286  
Abstract: Predictive maintenance is considered as one of the helpful techniques to improve the manufacturing process, especially in high-mixed semiconductor manufacturing suffered from the frequent tool failing behavior. Prognostics is a good solution to inferring the failing occurrence and realizing predictive maintenance. Because of the complicated and unclear tool failing phenomena, it is difficult to model the tool failing behavior by mechanism analysis. The difficulty impedes the development of prognostics in semiconductor manufacturing. As data-driven methods aim at estimating future behaviors without knowledge of the underlying failing phenomena, this article proposes a novel data-driven prognostic method based on auto-associative Gaussian process regression to infer the tool failing behavior in semiconductor manufacturing. Through extracting the failing factors, determining the failing degree and constructing the prognostic model, the tool failing behavior tendency is predicted and the suitable chamber cleaning time is determined to improve the productivity and save the cost of semiconductor manufacturing. The effectiveness and practicality of the proposed method are demonstrated by a practical semiconductor manufacturing factory. The obtained prognostic results can help operators understand the tool failing behavior better and guide decision-makers to make a suitable plan for chamber cleaning in semiconductor manufacturing.  
keywords: {prognostic;tool failing behavior;auto-associative regression;Gaussian process regression;semiconductor manufacturing},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067286&isnumber=9067096>  
  
J. de las Morenas, C. M. da Silva, G. S. Funchal, V. Melo, M. Vallim and P. Leitao, "Security Experiences in IoT based applications for Building and Factory Automation," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 322-327.  
doi: 10.1109/ICIT45562.2020.9067229  
Abstract: Industry 4.0 and Industrial Internet of Things (IIoT) are promoting the connection of millions of devices, that once were seen as unconnectable, into a huge network, to be used in a large number of applications, from autonomous vehicles to industrial control systems, passing through building automation systems. These paradigm rely on the adoption of Cyber Physical Systems complemented with Internet of Things (IoT) technologies and artificial intelligence techniques. These type of systems are responsible for collecting, processing and exchanging a vast amount of data, and for that reason, it is imperative to assure data integrity and protection against malicious modifications and attacks to ensure a safe and reliable operation. Data thefts and cyber attacks in general represent a significant danger, however, cyber attacks on IoT systems can be specially critical due to their proximity with humans, enhancing the risk of physical damage. This paper highlights the importance of securing these systems, pursuing a safer operation, having in mind the amount of security vulnerabilities found in embedded devices. For this purpose, this article studies possible security threats and weakness in two case studies coming from different IoT domains, i.e. building automation and factory automation, while seeking for solutions to improve these systems' security.  
keywords: {Building automation;Internet of Things;Data security;Industrial control;Cyber-physical systems;Cyber-security;Industry 4.0;Internet of Things;Cyber-Physical System},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067229&isnumber=9067096>  
  
T. Lackorzynski, P. Rietzsch and S. Köpsell, "Switchbox - Low-latency Fail-safe Assurance of Availability in Industrial Environments," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 328-333.  
doi: 10.1109/ICIT45562.2020.9067303  
Abstract: The application of the latest trends to industrial networks under the vision of Industry 4.0 will bring among other things the introduction of middleboxes. These middleboxes will bring much flexibility and will be necessary to implement new use cases. Yet, they will also add additional points of failure to an industrial environment where safety and availability of services trump any other considerations. Therefore, we propose a solution that tries to balance the conflicting goals of deploying middleboxes into critical industrial environments while at the same time guaranteeing the availability of the communication path the middlebox sits on. We show, that our solution is highly performant, small in footprint and delivers a higher security level.  
keywords: {Middleboxes;Switches;Security;Production facilities;Software;Automation;Industries;Industry 4.0;Industrial IoT;IIoT;Industrial Automation;Industrial Networks;Middleboxes;Safety;Security},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067303&isnumber=9067096>  
  
M. Azangoo, J. O. Blech and U. D. Atmojo, "Towards Formal Monitoring of Workpieces in Agile Manufacturing," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 334-339.  
doi: 10.1109/ICIT45562.2020.9067188  
Abstract: Information about the locations of objects is one of the main ingredients of Industry 4.0. With the increased use of flexible and agile manufacturing techniques, the monitoring of workpieces in a factory can become more challenging. In this paper, we present a state-machine-based approach for monitoring workpieces using sensors such as RFID readers. We present a solution where each object is represented as a deterministic state machine to monitor the object's journey throughout production via this state machine representation. Multiple objects can be monitored at the same time by running parallel event-based state machines. We present an implementation of our solution using RFID-Readers and OPC UA.  
keywords: {Monitoring;Radiofrequency identification;Agile manufacturing;Sensor systems;Automation;industry 4.0;automation;agile manufacturing;OPC UA;deterministic state machine;factory of the future;monitoring},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067188&isnumber=9067096>  
  
"IEE Industrial Electronics and Education," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 340-342.  
doi: 10.1109/ICIT45562.2020.9067258  
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URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067258&isnumber=9067096>  
  
J. Siegert, L. Zarco and T. Schlegel, "Universal Accessibility Concept for Controlling Production Means in Manufacturing Systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 349-354.  
doi: 10.1109/ICIT45562.2020.9067194  
Abstract: Production systems must be increasingly agile and flexible, and thus more complex in order to meet the current demands of the market regarding the integration of the client in the design and development of individualized products. In turn, the requirements of machine and worker expertise increase parallel to the complexity of production systems, limiting the inclusion of persons like elderly and disabled people, in flexible production processes. This paper describes a new paradigm in which the reliability and accuracy of production system control and configuration is achieved through a universal accessibility design avoiding the need of complicated and specific knowledge or training to perform determined tasks in a modular, adaptable, intuitive and recreational way.  
keywords: {Production facilities;Task analysis;Production systems;Solid modeling;Complexity theory;Usability;Flexible manufacturing systems;human-machine collaboration;robot controlling;universal usability;inclusion},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067194&isnumber=9067096>  
  
A. Benis, S. A. Nelke and M. Winokur, "Upgrading Industrial Engineering and Management curriculum to Industry 4.0," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 355-359.  
doi: 10.1109/ICIT45562.2020.9067243  
Abstract: Introducing up-to-date Industrial Internet of Things and small robots, in other words Industry 4.0, related concepts to students of a Bachelor of Science degree in Industrial Engineering and Technology Management. The degree until now mainly focused on Industry 3.0 using Programmable Logical Controllers and only support software for class exercises without automated teaching robots. At the Holon Institute of Technology, in Israel, the Faculty of Technology Management is dealing with this subject matter and upgrading its curriculum. The paper presents the needs for preparing the students to technology challenges in the industrial environment. It relates the local experience current results and future expected continuous improvements.  
keywords: {Industries;Technology management;Education;Service robots;Automation;Laboratories},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067243&isnumber=9067096>  
  
"MR - Mechatronics and Robotics," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 360-362.  
doi: 10.1109/ICIT45562.2020.9067256  
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T. Okano and T. Murakami, "An Approach to Success-based Data Compression Considering Position/Force Task," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 363-368.  
doi: 10.1109/ICIT45562.2020.9067162  
Abstract: The number of robots has been increasing and they would widely conduct activities in a variety of situations. The amounts of motion data distribution would also become larger and larger: therefore, the amounts of each motion data are expected to be compressed. The compression of motion data has been widely discussed, but this study focuses on the success-based approach and considering a position/force task. Since the purpose of machine automation is to conduct some tasks, the data can be compressed in the extent that the task is safely and successfully completed. The sampling time of command loading is changed for reducing the amount of motion data. The algorithm for investigating the required sampling times in each motion period and each degrees-of-freedom is developed and applied, and the appropriate values were experimentally obtained. The data compression of motion commands was confirmed as well as the task success based on its compressed motion command.  
keywords: {Task analysis;Force;Automation;Data compression;Force control;Robots;Acceleration},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067162&isnumber=9067096>  
  
L. Romeo et al., "Automated Deployment of IoT Networks in Outdoor Scenarios using an Unmanned Ground Vehicle," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 369-374.  
doi: 10.1109/ICIT45562.2020.9067099  
Abstract: Latest research in the integration of robotics and Internet of Things (IoT) systems paved the way for the development of new and potentially disruptive technologies, with applications in critical domains such as surveillance, environmental monitoring, smart agriculture and ambient intelligence in general. In this work, a robotic-aided IoT system for the automatic deployment of sensor networks is developed. Specifically, an Unmanned Ground Vehicle (UGV) is used to look for the best suitable deploying positions of the IoT nodes in extensive environments, such as in outdoor settings, based on the Received Signal Strength Indicator (RSSI) value measured between IoT devices. The system exploits accurate robot localization information obtained by integrating odometry, inertial and Global Position System (GPS) measurements. IoT nodes implement an IPv6 protocol, with IEEE 802.15.4 (6TiSCH) technology and make use of multi-hop communications, so as to guarantee an IoT network topology that provides wide coverage. Experimental results carried out in a real outdoor context are presented to demonstrate the feasibility of the system. It is shown that compared to a manual deployment, the proposed robotic-aided approach leads to higher performance, thus increasing communication efficiency between nodes and attaining stable IoT network topology.  
keywords: {Robot sensing systems;Robot kinematics;Monitoring;Mobile robots;Network topology;robotic-aided IoT;automatic deployment;industrial internet of things},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067099&isnumber=9067096>  
  
S. Hosseini and I. Hahn, "Kinodynamic Motion Planning and Energy Loss Cost Function Modelling for a 2- DOF Robot Arm Manipulator," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 375-380.  
doi: 10.1109/ICIT45562.2020.9067281  
Abstract: This paper proposes an energy efficient motion planning for industrial robots with a novel cost function formulation. The dynamics of the 2-DOF (degree of freedom) robot arm manipulator, models the inertia and mass related losses, Coriolis and centrifugal losses of each link, friction losses and losses related to the gravity. A DC motor is used in each joint to drive the manipulator. For the point-to-point (PTP) trajectories, a fifth order polynomial is considered. Furthermore, the torque analysis with respect to the already mentioned loss terms is done and its effect on the overall electrical and mechanical losses is discussed. These torques and losses analyses are gained by the forward dynamics and inverse kinematics of the 2-DOF manipulator. In the last part, the simulation results of the power losses cost function (PLCF) with respect to the terms associated to velocity and acceleration of each link in every single time instant of the motion is modelled.  
keywords: {Manipulator dynamics;Cost function;DC motors;Torque;Energy loss;Robots;forward dynamics;inverse kinematics;power losses cost function;energy losses;polynomial},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067281&isnumber=9067096>  
  
M. Gerngroß, M. Kohler, C. Endisch and R. Kennel, "Model-Based Control of Nonlinear Wire Tension in Dynamic Needle Winding Processes," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 381-388.  
doi: 10.1109/ICIT45562.2020.9067168  
Abstract: A defined wire tension force at the nozzle exit is crucial for reproducible and precise wire deposition in a needle winding process. The estimation of wire tension with an Extended-Kalman-Filter (EKF), presented in a prior publication, was evolutionarily refined in this work. To advance emulation of nonlinear bending forces for tension simulation, neural networks were introduced. A comparison between estimation by an EKF with excluded updates and by a random walk EKF proved valid model quality. Loose wires were detected with an additional functional module. To prevent loose windings, wire tensions at the nozzle exit were controlled with a model predictive control approach. This controller was validated by dynamically adjusting the reference wire tensions during winding.  
keywords: {Wires;Windings;Pulleys;Force;Brakes;Stators;Needles},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067168&isnumber=9067096>  
  
K. Sekiya and T. Murakami, "Pushing Control of Mobile Robot by Adjusting Deceleration Time according to Estimated Friction Effect," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 389-394.  
doi: 10.1109/ICIT45562.2020.9067260  
Abstract: Recently, attention has been paid to pushing task by robots. A flexible mobile robot with a spring was devised to achieve safe contact during the pushing task. In this paper, two types of pushing task were assumed, one is pushing a fixed object and second is pushing a mobile object. A control law for flexible mobile robots to perform these tasks was proposed. The first is resonance ratio control for force control on a fixed object. Second, deceleration time adjustment method was proposed to carry mobile object without overrunning the target position. Also an observer to estimate friction was proposed, which is an index for adapting deceleration time. The performance of the proposed methods ware verified by simulation.  
keywords: {Task analysis;Friction;Force;Mobile robots;Acceleration;Robot kinematics;Flexible Mobile Robot;Pushing Task;Friction Estimation Observer;Deceleration Time Adjustment},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067260&isnumber=9067096>  
  
A. C. Coninch Perin, R. G. Scortegagna, K. Hoffmann, J. A. Fabro, A. S. de Oliveira and M. Januário, "Simulation and Implementation of an Autonomous Mobile Robot for Outdoor Competitions," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 395-400.  
doi: 10.1109/ICIT45562.2020.9067268  
Abstract: In this paper is presented the design, construction and evaluation of an autonomous mobile robot, designed to outdoor competitions. The category of outdoor competition, in Brazil named Trekking Pro, is based on a mobile robot in an open field, which must pass through preset coordinates. A commercial (at first remote controlled) robot was adapted for autonomous operation. The perception of the robot consists of 9-axis Absolute Orientation Sensor and an encoder. At fist, the system was simulated in a ROS (Robotic Operation System) environment integrated with a scene V-REP (Virtual Robot Experimentation Platform). PID controllers, were used in implementation. Afterwards, a prototype was built, that participated in a competition with success, winning the first place. Both simulation and real-world experimental results of the constructed prototype are shown in detail. The robot described in this paper was the champion of the Winter Challenge 2018 (Robocore - Brazil) in the Trekking Pro category.  
keywords: {Robot sensing systems;Robot kinematics;Hardware;Mobile robots;Global Positioning System;Pulse width modulation;robot;autonomous;mobile;outdoor;control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067268&isnumber=9067096>  
  
D. Maune, B. Krüger, P. Sahm and S. Soter, "Speed Control for Lifting Devices with Conical Cable Drum through Indirect Position Determination," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 401-405.  
doi: 10.1109/ICIT45562.2020.9067244  
Abstract: Lifting devices are often provided with a spring to compensate their constant weights. But because the force of a spring is depending on its stretch, the compensation ratio during a lifting process is fluctuating. By changing the characteristic of the load with the help of a variable radius drum it is possible to mitigate this drawback. In this paper a torsion spring and a conical cable drum are used for compensation. Because the wound cable length per revolution is changing, the lifting speed also varies. For the introduced speed controller the position of the drum is measured with an absolute, magnetic sensor. The actual lifting speed is then indirectly determined by calculation utilizing the cable drum parameters.  
keywords: {Shafts;Springs;Torque;Velocity control;Magnetic circuits;Integrated circuits;Position measurement;lifting device;torsion spring;passive torque compensation;cable drum;variable radius drum;magnetic position sensor;speed control},  
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M. Fukui, G. Kokubun and T. Nozaki, "Visualization of Important Human Motion Feature Using Convolutional Neural Network," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 406-411.  
doi: 10.1109/ICIT45562.2020.9067143  
Abstract: Human motion feature extraction is necessary for robot motion generation. In particular, feature extraction methods related to non-periodic motion should be proposed. Recently, the number of the human motion recognition studies utilizing Convolutional Neural Network (CNN) is increasing due to the brilliant ability of extracting and identifying features. CNN has the same or better discrimination ability than humans so that the features extracted by CNN are thought to be useful for human motion understanding. However, since the internal structure of CNN is like a black box, it is difficult to understand the extracted features. In order to understand the features, some visualization methods which are utilized in the image field are applied in this paper. Furthermore, the many conventional studies utilizing the gradient are not preferred for visualizing CNN which recognizes human motion because human motion is sensitive for the object which treated. That is, the gradient method does not work because the value varies greatly depending on the environment even in the same motion. Therefore, new visualizing method without using the gradient is proposed in this paper. The proposed method visualizes CNN focusing part by following the neuron in CNN. Since this method does not require the gradient, the stable and accurate visualization can be performed. The effectiveness is shown by experiments.  
keywords: {Feature extraction;Neurons;Visualization;Force;Robot motion;Principal component analysis;CNN;HAR;human motion;visualization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067143&isnumber=9067096>  
  
"PE - Power Electronics and Energy Conversion," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 412-414.  
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D. Sun, C. Huang, T. Li, C. Wang, Z. Wang and W. Gu, "A Digitally Controlled Single-Inductor Dual-Output Buck Converter with Low Cross-Regulation and Fast Dynamic Response," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 415-420.  
doi: 10.1109/ICIT45562.2020.9067179  
Abstract: In this paper, a new digitally controlled single-inductor dual-output (SIDO) converter is proposed to improve the performance during the transient process. A SIDO buck converter operating in continuous conduction mode (CCM) is taken as an example to analyze the operation. The proposed digital control method consists of an inductor current predictive control method and an equivalent zero-charge method, which can suppress the cross-regulation and reduce the response time, respectively. The proposed digital control method is implemented via the field programmable gate array (FPGA) platform. Compared with the traditional proportional-integral-derivative (PID) control method, the response time is reduced from 5 ms to 10 us, and the cross-regulation is reduced from 1.27 mV/mA to 0.055 mV/mA when the load current changes from 180 mA to 360 mA.  
keywords: {Single-inductor dual-output;cross-regulation;dynamic response;inductor current predictive control method;equivalent zero-charge method},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067179&isnumber=9067096>  
  
L. S. Mai, S. A. Mussa, A. A. Schwertner and M. F. Schonardie, "A GaNFET Based 1MHz Switching DC-DC Three-Phase Interleaved Point of Load Buck Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 421-425.  
doi: 10.1109/ICIT45562.2020.9067277  
Abstract: This paper presents the design and development of a DC-DC step-down converter, operating with 1 MHz switching frequency. The use of this switching frequency is intended to reduce the physical size of the device. To achieve this operating frequency, while maintaining acceptable levels of efficiency, GaN-FET transistors are used. The converter acts on the Synchronous Buck scheme and converts 12 V to 1 V supporting 30 A of output current. The control is performed by the TPS53632 integrated circuit and three LMG5200 power stage integrated circuits are also used, both are manufactured by Texas Instruments. The tests performed with the converter demonstrates a peak efficiency of 85%, reducing to 70% at maximum load. In addition to the design of the converter, this paper addresses the losses calculation for a comparison between GaNFET and MOSFET based converters, the effects of using a high frequency switching, as well as techniques available to reduce these effects.  
keywords: {Transistors;Gallium nitride;Logic gates;Switches;Capacitors;Switching loss;Inductors;GaNFET;High Frequency Switching;Point of Load;VRM;Synchronous Buck},  
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F. Lima de Sa, C. Dal Agnol, W. Raphael, D. R. Caballero and S. A. Mussa, "A New DC-DC Double Zeta Quadratic Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 426-431.  
doi: 10.1109/ICIT45562.2020.9067314  
Abstract: This paper presents a study of a new dc-dc non-isolated high gain converter called Double Zeta Quadratic Converter. From a single basic switching cell of a family of quadratic converters, the topological states, the waveforms of voltage and current, and the output characteristic graph of the converter are presented in this paper. To prove the advantages of this new topology as the high static gain and high efficiency, the raised curves are illustrated. Besides, the experimental results of the proposed converter are presented in this paper.  
keywords: {Capacitors;Inductors;Prototypes;Mathematical model;DC-DC power converters;Topology;Switches;DC-DC Converter;Zeta Converter;Quadratic Converter},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067314&isnumber=9067096>  
  
A. Ammar, H. Y. Kanaan, N. Moubayed, M. Hamouda and K. Al-Haddad, "A Review on Three-phase AC/AC Power Converters Derived from the Conventional Indirect Matrix Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 432-437.  
doi: 10.1109/ICIT45562.2020.9067114  
Abstract: The growing permeation of green renewable energies into electrical systems has been considerably remarked in industry. Thriving integration of these external sources into the current grid massively depends on allotted power converters and enormously counts on their specifications and control methods. In this scenario, and in relation to what was previously mentioned, this paper reflects a review of three-phase AC/AC power converters derived from the conventional indirect matrix converter.  
keywords: {Matrix converters;Legged locomotion;Topology;Inverters;Network topology;Insulated gate bipolar transistors;Rectifiers;I Grid connection;conventional indirect matrix converter;power converters;common inputs;various outputs},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067114&isnumber=9067096>  
  
N. García, L. Sánchez, J. A. Riveros, J. Prieto and M. Rivera, "An Overmodulation Strategy Based on a Generalised Duty Cycle Solution for Three- Phase Inverters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 438-443.  
doi: 10.1109/ICIT45562.2020.9067140  
Abstract: This paper extends a two-level three-phase pulse width modulation technique recently developed to synthesise reference voltages in the overmodulation interval. The method is based on a generalised analytical solution of the voltage-time law derived with the reference voltage in the stationary frame and the duty cycles. The strategy compensates the magnitude of the target voltage with a proposed preprocessor, which has been developed to work also with the duty cycles. The architecture enables the generation of output voltages in the two well-known overmodulation zones up to the six-step operation with a simple and fast algorithm. The modulator is validated with simulation and experimental tests, demonstrating a good response in the time domain and voltage/current spectra with a low amount of undesired harmonics.  
keywords: {Support vector machines;Switches;C# languages;Table lookup;Pulse width modulation;Harmonic analysis;Pulse width modulation;DC-AC power converters},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067140&isnumber=9067096>  
  
C. A. Felipe, E. L. Carvalho, E. G. Carati, L. Michels, L. V. Bellinaso and R. Cardoso, "Analytical Methodology to Design Third-Order Filter (LCL) for Battery Chargers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 444-449.  
doi: 10.1109/ICIT45562.2020.9067120  
Abstract: This paper presents an analytical methodology to design inductive-capacitive-inductive (LCL) filters applied to stationary battery chargers/dischargers. Second-order filters (LC) are commonly used in this application to reduce the voltage and current ripple on the batteries. However, to comply with the requirements of batteries standards, low order filters are commonly bulky and increase the cost and losses related to the PWM converters. The filter design must consider the ripple of voltage and current required on the batteries, and possible configurations of the dc-dc converter implementation. The proposed methodology considers a few cases, including unidirectional Buck and Boost converters, bidirectional Buck-Boost, and isolated configurations. Experimental results are shown to illustrate the proposal.  
keywords: {Batteries;DC-DC power converters;Design methodology;Inductors;Standards;Capacitors;Charge controllers;dc-dc converters;energy storage systems;(LCL) filter design},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067120&isnumber=9067096>  
  
E. Velázquez-Elizondo, I. Cervantes, I. Araujo-Vargas and K. Cano-Pulido, "Averaged Models of a Six-Phase, Dual-Interleaved DC-DC Buck-Boost Converter with Interphase Transformers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 450-455.  
doi: 10.1109/ICIT45562.2020.9067235  
Abstract: DC-DC converters with interphase transformer are commonly used to achieve high power density levels and high efficiency. The interleaving technique produces an increment in the ripple frequencies, reducing passive components weight and size; while an increment of phases leads to a higher power density; nevertheless, a controller is required to prevent current imbalances. As a preliminary step in the development of the control of such complex designs and to understand the dynamical limitations of a highly interleaved converters, a model should be obtained. In this paper, two average models of a six-phase dual-interleaved Buck-Boost converter are developed using an averaged switch circuit approach. Time domain tests along the frequency response of the system are used to evaluate the performance of the models using Saber simulations as a reference. The models are evaluated under nominal and extreme operating conditions.  
keywords: {Integrated circuit modeling;Mathematical model;Density measurement;Power system measurements;DC-DC power converters;Load modeling;Steady-state;buck-boost;small-signal model;large-signal model;interphase transformer;dual-interleaved;high power density},  
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G. Rojas-Dueñas, J. Riba, K. Kahalerras, M. Moreno-Eguilaz, A. Kadechkar and A. Gomez-Pau, "Black-Box Modelling of a DC-DC Buck Converter Based on a Recurrent Neural Network," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 456-461.  
doi: 10.1109/ICIT45562.2020.9067098  
Abstract: Artificial neural networks allow the identification of black-box models. This paper proposes a method aimed at replicating the static and dynamic behavior of a DC-DC power converter based on a recurrent nonlinear autoregressive exogenous neural network. The method proposed in this work applies an algorithm that trains a neural network based on the inputs and outputs (currents and voltages) of a Buck converter. The approach is validated by means of simulated data of a realistic nonsynchronous Buck converter model programmed in Simulink and by means of experimental results. The predictions made by the neural network are compared to the actual outputs of the system, to determine the accuracy of the method, thus validating the proposed approach. Both simulation and experimental results show the feasibility and accuracy of the proposed black-box approach.  
keywords: {neural network;power converter;training;prediction;system identification;black-box model},  
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D. O. Neacşu and B. Lehman, "Computerized Performance Validation for a Solar Inverter with Flash-Memory-Based PWM," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 462-467.  
doi: 10.1109/ICIT45562.2020.9067221  
Abstract: This paper further develops the concept of very large size flash-memory-based pulse-width-modulation (PWM) with an application to a three-phase IGBT solar inverter. Using flash memory demonstrates a low-cost alternative to advanced processors and allows the implementation of multiple optimization methods for current harmonics reduction or efficiency improvement. A previously-reported optimized solution is applied herein and both thermal regime and efficiency are analyzed using PSIM models to prove a 33% semiconductor power loss reduction near highest modulation index and near unity power factor. This translates to the new flash PWM method providing around 1.5% higher efficiency when using the European or California efficiency standards for solar industry, compared to a typical -91% (European) efficient conventional IGBT solar inverter using the same devices. Finally, results for GaN transistors are discussed.  
keywords: {Pulse width modulation;Inverters;Frequency modulation;Insulated gate bipolar transistors;Flash memories;Harmonic analysis;solar inverter;PWM algorithm;flash memory;IGBT;GaN transistors;PSIM simulation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067221&isnumber=9067096>  
  
M. Comanescu, "Estimation of THD, Harmonic Components and Power Factor in Three-Phase Rectifiers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 468-473.  
doi: 10.1109/ICIT45562.2020.9067212  
Abstract: Three-phase apparatus such as rectifiers and inverters are widely used in industrial applications. To achieve the required performance, these power converters are controlled using digital signal processors (DSPs) that implement relatively complex embedded control software. Along with the mandatory real-time code that controls the switching of the converter, these DSPs also need to measure, compute, estimate, monitor and report other quantities of interest like active and reactive power, rms value of voltages and currents, magnitude of the fundamentals and of the 5th, 7th, 11th, 13th harmonics, total harmonic distortion (THD), power factor etc. Therefore, along with the primary control code that generates switching signals for the converter, the DSP needs software that computes all these quantities and reports or displays them. This paper considers a three-phase rectifier and presents a method to compute the rms value of the line current, the magnitude of the fundamental, the magnitudes of the 5th, 7th, 11th and 13th harmonics, the THD; also, the harmonic power factor, the displacement power factor and the total power factor. The paper shows the mathematics involved as well as simulations. The method can be applied to other three-phase converters.  
keywords: {Harmonic analysis;Reactive power;Rectifiers;Power harmonic filters;Voltage measurement;Phase locked loops;three-phase rectifier;three-phase inverter;harmonic content;total harmonic distortion;power factor;harmonic power factor;displacement power factor},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067212&isnumber=9067096>  
  
T. Sugimoto, T. Nozaki and T. Murakami, "Extended T-Type Boost Inverter for Capacitance Reduction," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 474-479.  
doi: 10.1109/ICIT45562.2020.9067103  
Abstract: In these days, multilevel inverters are focused thanks to their advantages, such as small voltage stress, low electromagnetic interferences, and harmonics reduction. Generally, renewable energy sources output a low DC voltage. From the viewpoint of efficiency, a single-stage conversion system which can directly change the lower DC-link voltage to higher AC voltage is required. Some single-stage conversion systems have been proposed before. However, these systems have large energy storage such as an inductor and a capacitor. This paper proposes a multilevel boost inverter stepping up the AC output peak voltage at any boost ratio by changing the number of switched capacitors. To reduce the capacitance, the proposed inverter has multiple conduction patterns when the output voltage is boosted. This characteristic distributes the discharging time to multiple capacitors. This inverter can set any maximum boost ratio and apply to the multiphase applications. The operation principle and the boost ability with multiple boost ratios were confirmed by simulations and experiments. The capacitance reduction was also confirmed by simulations.  
keywords: {Inverters;Capacitors;Switches;Capacitance;Stress;Topology;Proposals;multilevel inverter;boost converter;Pulse Width Modulation (PWM);switched capacitor},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067103&isnumber=9067096>  
  
G. Gateau, M. Cousineau, M. Mannes-Hillesheim, T. Robert and P. Q. Dung, "High Dynamic Current Control Using Decentralized PWM Generation for Parallel Multiphase Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 480-486.  
doi: 10.1109/ICIT45562.2020.9067112  
Abstract: This paper presents the study of a high dynamic current control strategy using the decentralized principle for a parallel multiphase converter. The control of the output current by the use of stacked equivalent carriers allows to obtain very fast dynamics while the use of decentralized local control provides robust balancing of the currents in each phase. Each phase regulates its own current simply and only by using information from neighboring cells. The first part of the paper will present this high dynamic control of output current then in the second part the decentralized principle will be used for the PWM generation and balancing of the currents in the parallel association of the converter cells.  
keywords: {Pulse width modulation;Simulation;Switches;Load modeling;Current control;Mathematical model;Bandwidth;Power Electronics;Multiphase Converter;Decentralized Control;Masterless Interleaving PWM and Digital Control;Dynamic reconfiguration},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067112&isnumber=9067096>  
  
D. Murillo-Yarce, J. Munoz and C. Restrepo, "Mamdani type PI-fuzzy controller in a boost converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 487-492.  
doi: 10.1109/ICIT45562.2020.9067257  
Abstract: This paper proposes a PI-fuzzy controller to control the output voltage of a boost converter. The Mamdani PI-fuzzy controller operates from a set of rules emulating the behavior of a Classical-PI controller, without estimating the proportional and integral constants. The fuzzy control poses a set of nine basic rules. Performance of the proposed controller is validated by simulation and compared with a deadbeat controller. Controllers were implemented in Matlab/Simulink. The fuzzy-PI controller has zero steady state error and excellent dynamic response to different references, but it presents greater ripple in the inductor current. This research demonstrates that the fuzzy-PI controller is a good alternative for controlling power converters and non-linear systems.  
keywords: {Switches;Inductors;Fuzzy control;Mathematical model;Voltage control;Topology},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067257&isnumber=9067096>  
  
R. E. Pérez-Guzmán, M. Rivera, J. A. Riveros, F. Herrera and P. W. Wheeler, "Model Predictive Control Applied to the Three-Phase Neutral Point Clamped Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 493-498.  
doi: 10.1109/ICIT45562.2020.9067298  
Abstract: Model-based predictive control is one of the most used strategies for power converters. Its popularity is due to the simple inclusion of several regulation objectives in the control law, which is a desired feature for multilevel voltage source inverters. This research presents the implementation of predictive control methods for three-level neutral-point clamped inverters. A classical and a fixed switching frequency algorithms are evaluated to compare the performance of the techniques. The results show the benefits of predictive controllers and the contributions of the fixed switching frequency scheme.  
keywords: {Capacitors;Switches;Inverters;Voltage control;Frequency control;Mathematical model;Predictive models;Neutral-point clamped inverter (NPC);model predictive control;fixed frequency;variable frequency},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067298&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067217  
Abstract: In the last year model predictive control strategy has emerged as a good alternative for the control of power converters. This research proposes a new model-based predictive control strategy for a voltage source inverter, operating at variable and fixed switching frequency, with the objective of comparing the performance of the control algorithm and the output variables. The experimental results show the benefits of predictive control and the superiority of fixed frequency control strategies instead of the variable switching frequency. Based on the total harmonic distortion (THD) and the absolute error, we can prove that better results are obtained by forcing the converter to commutate at fixed frequency.  
keywords: {Predictive control;Cost function;Switches;Mathematical model;Inverters;Frequency control;Predictive models;Model predictive control (MPC);three-phase inverters;variable switching frequency;fixed switching frequency},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067217&isnumber=9067096>  
  
A. Edpuganti, V. Khadkikar, H. Zeineldin, M. S. Elmoursi and M. Al Hosani, "New Submodule Selection Algorithm for Low Device Switching Frequency Modulation of Medium-Voltage Modular Multilevel Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 505-510.  
doi: 10.1109/ICIT45562.2020.9067187  
Abstract: Low device switching frequency is preferred in high-power converters to achieve higher efficiency, higher device utilization, and feasible cooling system design. However, low device switching frequency operation leads to higher peak voltage in submodule (SM) capacitors of medium-voltage modular multilevel converters (MMC). The main reason is unequal distribution of energy among SMs in each fundamental period due to fewer switching commutations available for balancing. This results in increased converter cost due to higher voltage rating of SM capacitors and semiconductor devices. Therefore, the main objective of this paper is to propose a new SM selection algorithm to reduce the peak voltage of SM capacitors without significantly increasing the device switching frequency. The main idea is to avoid unnecessary switching commutations by ensuring balancing of SM capacitor voltages only at the end of charging period. The proposed algorithm has been verified with extensive simulation studies of a 5L-MMC and it has been observed that peak voltage is kept within 10 % of the nominal value while limiting the device switching frequency in the range of 350 to 400 Hz.  
keywords: {Capacitors;Switches;Switching frequency;Modulation;Harmonic analysis;Topology;Sorting;Modular multilevel converter (MMC);Low device switching frequency modulation;Submodule capacitor voltage ripple minimization;synchronous optimal pulsewidth modulation (SOP)},  
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L. Curos, T. Dubois, G. Mejecaze, F. Puybaret and J. . -M. Vinassa, "Susceptibility Modelling of SMPS Input Stage Under High Current Pulse Injection," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 511-516.  
doi: 10.1109/ICIT45562.2020.9067183  
Abstract: This paper presents a model able to reproduce the behavior of switch-mode power supply (SMPS) under a high-level current pulse injected at its input. In fact, such injected current involves particular phenomena that component models manufacturer have not been considered. To improve the SMPS model, some components particular behaviors have to be analyzed. Saturation phenomena in common mode chokes and rectifier bridge reverse recovery are especially considered by modelling. These phenomena have been modelled thanks to current and impedance measurements and integrated in an electronic simulation software. Finally, common mode chokes and rectifier bridge new models improve simulation results in accordance with measurement.  
keywords: {Inductors;Switched mode power supplies;Current measurement;Rectifiers;Integrated circuit modeling;Bridge circuits;Switches;Susceptibility;switch-mode power supply;common mode choke saturation;rectifier bridge reverse recovery modelling;IEMI},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067183&isnumber=9067096>  
  
Q. Phan, G. Gateau, M. Cousineau, L. Veit, R. De Milly and M. Mannes-Hillesheim, "Ultra-fast Decentralized Self-Aligned Carrier Principle for Multiphase/Multilevel Converters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 517-522.  
doi: 10.1109/ICIT45562.2020.9067108  
Abstract: This paper proposes an ultrafast decentralized self-aligned carrier principle for a multilevel or multiphase converter using phase-shifted (PS) or level-shifted (LS) carriers PWM method. Each cell of the converter synchronizes and updates simultaneously its own carrier angle or level based on the information share with its neighboring cell. As opposed to the classical decentralized control method based on the calculations of carrier angle with an iteration process and applied to PS-PWM, the proposed ultra-fast decentralized self-aligned carrier principle offers an instantaneous alignment for both PS and LS carriers. The simulation results show the effectiveness of the proposed method especially in the case of dynamic reconfiguration of the system including a large number of switching-cells.  
keywords: {Indexes;Pulse width modulation;Simulation;Switches;Steady-state;Flowcharts},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067108&isnumber=9067096>  
  
D. O. Neacsu, I. Pletea and A. Sirbu, "Worst-Case Design Procedure of a State-Space based Controller for a Boost Converter under Parameter Uncertainty," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 523-528.  
doi: 10.1109/ICIT45562.2020.9067125  
Abstract: State-space based control of power converters attempts to move the converter poles to a more favorable location with a simple linear relationship between state variables. The new desired location of the system poles is established from dynamic requirements with a design based on a nominal dataset. When converter parameters are different from design, the actual system performance yields deteriorated. This paper proposes to automatically detect the worst-case and to design for it so that any other parameter uncertainty or variation would still keep the converter within the expected dynamic performance. Simulation and experiment demonstrate the concept for a boost converter.  
keywords: {Matlab;Mathematical model;Aging;Capacitance;Poles and zeros;Inductance;Capacitors;State-space based control;boost converter;parameter variation;worst-case design},  
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"RE - Renewable Electric Energy Conversion, Processing and Storage," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 529-530.  
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J. L. de Souza Silva, T. S. Costa, K. B. de Melo, E. Y. Sakô, H. S. Moreira and M. G. Villalva, "A Comparative Performance of PV Power Simulation Software with an Installed PV Plant," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 531-535.  
doi: 10.1109/ICIT45562.2020.9067138  
Abstract: Photovoltaic (PV) energy stands out due to the sustainability aspect, being the target of research investments. At University of Campinas, the sustainable campus project carried out the installation of PV plants at the university with the challenge of conducting research in the Campinas-Brazil region. In this way, the present paper simulated the largest PV plant of University of Campinas (336.96 kWp) in different PV power simulation software, aiming to have data for future comparisons with the installed PV system. For this, is it used PVsyst, PV\*SOL, and HOMER for simulations, and then compared the result with the months containing the results of power generation for the installed PV plant. As a result, the three software performed well, with generation close to the installed PV plant. It was noticed HOMER optimism, PV\*SOL conservatism and a more accurate result for PVsyst. Therefore, the PV plant worked as designed and the peculiarities of the three software were presented as a contribution of the paper.  
keywords: {Software;Data models;Databases;Analytical models;Photovoltaic systems;Inverters;Photovoltaic;PV power simulation;PV plant;performance PV system},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067138&isnumber=9067096>  
  
R. R. Shrivastwa, A. Hably, S. Bacha, H. Mesnage and R. Guillaume, "An overview of Hybridization of Power sources for Ancillary Service," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 536-541.  
doi: 10.1109/ICIT45562.2020.9067178  
Abstract: Increasing Renewable Energy Sources (RESs) mix in the power grids, with advanced power electronic converters are meeting the demands but also are posing threats to the power system because of the impacts on the frequency/voltage stability and short circuit current mitigation issues. Obviously, with large hydro storage systems like the Pumped Storage Plants (PSPs) or other storage technologies, solutions of increasing grid stability and reliability can be found. But the characteristics of different technologies does makes the decision challenging. This paper gives an overview of how hybridization of power sources using different storage technologies can mitigate the impacts of the RES penetration into the grid.  
keywords: {Power generation;Time factors;Renewable energy sources;Power grids;Power electronics;Power system stability;Frequency control;PSPs;storage technologies;flexibility;grid dynamics;hybridization;RESs},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067178&isnumber=9067096>  
  
S. Vahid and A. El-Refaie, "Generalized Systematic Approach Applied to Design a Novel Three-Port Power Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 542-548.  
doi: 10.1109/ICIT45562.2020.9067254  
Abstract: There has been growing interest in multi-port power converters especially three-port converters (TPCs) over the past several years. The main reason is their growing use in applications like solar and traction applications to combine different blends of energy sources/storage. Even though there is a large body of work that exists in literature and a large number of topologies proposed as well as a few review papers, there is no generalized systematic approach explaining how to develop/design a TPC based on the involved inputs and outputs. This paper presents this generalized systematic approach. The proposed approach will be applied to two cases and the topologies that evolve out of this process will be discussed. The paper will also cover in a more comprehensive way the various modes of operation of a TPC. Also, the proposed approach has been used to develop a novel three-port power converter and the simulation results will be presented.  
keywords: {Topology;Batteries;Capacitors;Systematics;Inductors;Bridges;Feeds;Three-port;Power Converter;Design;Generalized;Systematic;Approach},  
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A. J. Hutchinson and D. T. Gladwin, "Sensitivity analysis of a wind farm with integrated flywheel energy storage," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 549-553.  
doi: 10.1109/ICIT45562.2020.9067176  
Abstract: Integration of quick response energy storage with wind-based generation sites has the potential to enhance the performance of these sites. Flywheel Energy Storage Systems (FESSs) are ideally placed to be utilized in this way due to their long lifetime and high cyclability. The effectiveness of this integration is dependent on a set of variables and constraints. A sensitivity analysis has been conducted to investigate the effect of changing system variables on output metrics using a mathematical simulation model.  
keywords: {Flywheels;Mathematical model;Sensitivity analysis;US Department of Defense;Wind farms;flywheel;energy storage;wind power;simulation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067176&isnumber=9067096>  
  
L. R. Tavares, T. S. Costa, K. B. de Melo, J. L. de S. Silva and M. G. Villalva, "Statistical analysis ANOVA and MANOVA of irradiation and temperature database for photovoltaic systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 554-559.  
doi: 10.1109/ICIT45562.2020.9067233  
Abstract: Photovoltaic solar energy has been exploited as a solution to meet the growing demand for electricity through a renewable source of energy. Optimized simulations of photovoltaic systems require the use of accurate solarimetric and climate data. This paper aims to compare the difference in solar radiation and temperature data provided by the NASA SSE and Meteonorm databases with the data measured by a real solarimetric station installed in Campinas, Brazil. Analyzes were performed using statistical methods such as analysis of variance from ANOVA and MANOVA. The analyzes present the hypothesis of equality with the significance of 95 % for each case is not rejected. Hypothesis rejection results occur in MANOVA analysis for temperature and irradiation data with daily data. The paper concludes that NASA SSE data is closest to the actual data.  
keywords: {Databases;Analysis of variance;Terrestrial atmosphere;Solar radiation;Temperature distribution;Radiation effects;Photovoltaic systems;ANOVA;MANOVA;irradiation database;photovoltaic system},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067233&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067248  
Abstract: Ultrasound-based indoor localization systems can be used for quality control in manual assembly processes by localizing objects such as tools or human hands. For this purpose, distances between objects attached to transmitters and room-fixed receivers are measured by time-of-flight measurements followed by multilateration to receive 3D positions. The time-of-flight values themselves are calculated in the receiver by circular correlation with model-based signal replicas. Many prototypes of these systems have been published in research. However, when implementing an economically scalable indoor positioning system based on off-the-shelf standard hardware components, some issues arise, out of which three major are focused on in this publication to optimize the localization performance: Firstly, an adaption circuit is presented to increase the bandwidth of the ultrasound transmission characteristic. This maintains the distance measurement accuracy high and keeps the variance low. Secondly, spectral leakage effects caused by the analog to digital converter's sampling frequency are mitigated with two approaches to decrease the measurement variance. Thirdly, an efficient circular correlation method is presented that allows the usage of field-programmable gate arrays by adapting the signals' lengths. Distance measurement experiments are presented to highlight the performance of these methods.  
keywords: {Ultrasonic imaging;Receivers;Correlation;Transmitters;Distance measurement;Hardware;Prototypes;Distance measurement;indoor navigation;ultrasonic transducers;wireless sensor networks},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067248&isnumber=9067096>  
  
R. Rojas et al., "Proposal of a Charge Monitoring Board for Thin Gap Chamber Detectors based on DRS4 chip," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 571-575.  
doi: 10.1109/ICIT45562.2020.9067149  
Abstract: The Muon Spectrometer of the ATLAS Experiment at CERN is composed of Thin Gap Chambers (TGC) and Monitoring Drift Tubes (MDT) technologies. TGCs are arranged in 6 Big Wheels and 2 Small Wheels. Gain stability and efficiency are required to be monitored during the Large Hadron Collider (LHC) operation (runs). A Charge monitoring board is identified as a solution to measure gain and efficiency during runs for the forthcoming High Luminosity upgrade. Specifications and topology are proposed with preliminary results as a demonstration of feasibility.  
keywords: {Monitoring;Wheels;Temperature measurement;Detectors;Mesons;Temperature sensors;Field programmable gate arrays;TGC;Monitoring;DRS4;FPGA},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067149&isnumber=9067096>  
  
F. A. Monteiro, T. Estrabis, R. Cordero, J. Montemor and J. O. P. Pinto, "Tuning of a Type-III Software-Based Resolver-to-Digital Converter through Genetic Algorithm," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 576-581.  
doi: 10.1109/ICIT45562.2020.9067196  
Abstract: Resolver is a sensor used in applications that require a reliable angle measurement. However, getting the angular position from the resolver outputs is a difficult task. Observers called resolver-to-digital converters (RDCs) are used to get the angular position from resolver. In many researches, RDCs are estimation algorithms (software-based RDCs). The transient response and robustness against noise of the angle estimation depends on the parameters of the RDC. This paper proposes the use of a genetic algorithm (GA) to set the parameters of a type-III software-based RDC. GA is a heuristic algorithm that search a solution that minimize a fitness function. In this paper, the solution is composed by the gains of the angular tracking observer (ATO) that composes the RDC. On the other hand, the cost function is a linear combination of the error peak, the settling time and the effect of noise in the angle estimation. Simulations shows that the angle estimation using the proposed approach has accuracy, good transient response and robustness against noise. Besides, GA allows customizing the ATO in order for the RDC to give an estimation where the noise rejection or the settling time is priority.  
keywords: {Genetic algorithms;Sociology;Statistics;Estimation;Windings;Robot sensing systems;Signal resolution;Angle tracking observer;genetic algorithm;resolver;software-based resolver-to-digital converter},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067196&isnumber=9067096>

D. Demetz, O. Zott and A. Sutor, "Wireless and Traceable Sensors for Internally Illuminated Photoreactors," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 582-586.  
doi: 10.1109/ICIT45562.2020.9067290  
Abstract: We present methods for developing wireless and traceable sensors for photobioreactors or photoreactors in general. The main focus of application are reactors which are wirelessly powered. Due to the promising properties of the propagation of magnetic fields under water we implemented an inductive link with an on/off switched hartley-oscillator as transmitter and an LC-tank as receiver. For this inductive link we used a carrier frequency of 298 kHz. With this system we performed measurements to demonstrate the independence of the magnetic field from water or salty water. In contrast we showed the strongly reduced range of RF-transmitter-receiver systems at higher frequencies (433 MHz and 2.4 GHz) in water and in salty water. For implementing the traceability of the sensors, we performed measurements to show the well defined orientation of the magnetic field of a coil. This information will be used in future work for implementing an inductive link based traceability system for our sensors.  
keywords: {Inductors;Receivers;Transmitters;Magnetic sensors;Wireless communication;Wireless sensor networks;wireless sensors;traceable sensors;photoreactor;internal illumination;wireless power},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067290&isnumber=9067096>  
  
"SG - Power Systems and Smart Grids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 587-588.  
doi: 10.1109/ICIT45562.2020.9067181  
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D. Hauer, D. Ratasich, L. Krammer and A. Jantsch, "A Methodology for Resilient Control and Monitoring in Smart Grids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 589-594.  
doi: 10.1109/ICIT45562.2020.9067283  
Abstract: The increasing importance of decentralized and volatile energy sources causes huge challenges for future energy grids. Besides intelligent grid planning, real-time monitoring and control is necessary to guarantee reliable and sustainable grid operation. The basis for such applications is dependable monitoring of the grid. This paper introduces a methodology for resilient control and monitoring. A self-healing algorithm ensures that the system can operate even when monitoring devices or connections fail. Based on that, a model-free context-aware monitoring algorithm allows for detection of anomalies, drift and, in general, undesired conditions. These core components are embedded in a scaleable system architecture that allow for easy integration even in existing systems.  
keywords: {Monitoring;Smart grids;Actuators;Meters;Reliability;Automation;Security;fault-tolerance;smart grids;dependable systems;context-aware monitoring;internet of things},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067283&isnumber=9067096>  
  
W. Ling, X. Yu, J. Wang and P. Sokolowski, "A Motif-based Classification Algorithm for Identifying Solar Panel Installations," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 595-600.  
doi: 10.1109/ICIT45562.2020.9067159  
Abstract: With increasing energy requirements and limitation of non-renewable resources for traditional electricity generation and transmission, many households and premises across the world have installed solar systems. Power companies require information about solar panel installations to regulate the whole power system. In this paper, we propose a motif-based classification algorithm for identifying whether a customer has installed the solar panels. Firstly, we symbolize our time-series data with alphabets and classify those data. Then we evaluate our method by checking error rates of different settings. Later, we test our algorithm with different training and testing datasets. The motif-based classification algorithm analyzes electricity consumption data of households. Results show that our motif-based classification algorithm for identifying solar panel installations have a very good accuracy.  
keywords: {Solar panels;Meters;Classification algorithms;Aggregates;Smart meters;Power demand;Companies;time-series data;classification;symbolic representation;motifs;solar panel installations},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067159&isnumber=9067096>  
  
M. Duraij, Y. Xiao, G. Zsurzsan, Z. Zhang, M. Hansen and B. Thomsen, "A Pragmatic Approach to Dynamic Behavior in Electrical Lines Used for Well Intervention Tools," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 601-606.  
doi: 10.1109/ICIT45562.2020.9067101  
Abstract: Electrical lines, also known as wirelines, are commonly used for well intervention techniques to increase flow of oil and gas wells that can be executed during a low service time. Previous studies show the importance of this electrical conductor for power delivery as well as communication purposes. Nevertheless, a validated model and its parameters of this channel are still missing. This papers outlines a geometrical approach to estimate the electrical dynamic behavior for wireline types used in the field with results supported by four different types of validation. The proposed method proves to capture the wireline dynamic behavior characteristics and is particular accurate in modeling the capacitive element within 5 %.  
keywords: {Insulators;Resistance;Conductors;Tools;Frequency measurement;Corrosion;Conductivity;Electric line;impedance modeling;well intervention;wireline},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067101&isnumber=9067096>  
  
V. Maask, T. Häring, R. Ahmadiahangar, A. Rosin and T. Korõtko, "Analysis of Ventilation Load Flexibility Depending on Indoor Climate Conditions," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 607-612.  
doi: 10.1109/ICIT45562.2020.9067153  
Abstract: Load flexibility and Demand Response are becoming increasingly important to balance the electricity supply and demand. Ventilation systems can be used as flexible loads in an electric power system. A number of studies in the field of load flexibility deal with ventilation system control in reference to measured temperature. However, inadequate attention is paid to the effect of using ventilation shutdown for providing load flexibility to pollutant concentration. This paper presents a ventilation shutdown period estimation according to indoor air quality (IAQ) for different space sizes and numbers of occupants. This study shows how long the ventilation system can be shut down before a pollutant concentration or temperature reaches its boundary considering the average level as an initial condition. Simulations were carried out to demonstrate an application of ventilation system 2-point control and to verify that this will not jeopardize the IAQ for normal conditions.  
keywords: {Ventilation;Buildings;Humidity;Temperature measurement;Heating systems;Pollution measurement;ventilation;Demand Response;flexibility;indoor climate;number of occupants},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067153&isnumber=9067096>  
  
A. Kadechkar, J. Riba, G. Rojas-Dueñas, J. A. Martinez and M. Moreno-Eguilaz, "Experimental Study of the Effect of Aeolian Vibrations on the Contact Resistance of Substation Connectors," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 613-618.  
doi: 10.1109/ICIT45562.2020.9067145  
Abstract: In the past, there have been some practical experiments to study the effect of high current and high temperature on the contact resistance of the substation connectors. However, there is a scarcity of practical works to study the effect of Aeolian vibrations. This paper presents an experimental study to analyze the effect of wind-induced vibrations on the contact resistance of the substation connector for tubular aluminum bus bars. Substation connectors are usually subjected to high current and high temperature stresses, thus being difficult to analyze the effect on vibrations when combined with these stresses. This paper presents a comparative study when the substation connectors operate with and without the effects of Aeolian vibration. Experimental results presented in this work show that the effect of vibrations on the contact resistance of the substation connectors is greatly influenced by the position of the connector and the type of mechanical support on the bus bar.  
keywords: {substation connector;contact resistance;lifetime;Aeolian vibration;temperature;high current;stress;bus bars},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067145&isnumber=9067096>  
  
A. Carrillo-Galvez, F. Flores-Bazán and E. López Parra, "On the solution of the Environmental/Economic Dispatch problem using Lagrangian duality," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 619-623.  
doi: 10.1109/ICIT45562.2020.9067261  
Abstract: In this paper, Lagrangian dual formulation is used to solve the Environmental/Economic Dispatch problem. The proposed method, that results quite different from the metaheuristic methods employed in literature, was tested on a six generating units system. The results obtained improve others reported in previous investigations, by simultaneously diminishing the total fuel cost and pollutants emissions.  
keywords: {Fuels;Quadratic programming;Linear programming;Power systems;Xenon;Two dimensional displays;duality theory;environmental/economic dispatch problem;quadratic programming},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067261&isnumber=9067096>  
  
D. Hauer, K. Diwold, M. Schuss, L. Krammer and T. Sauter, "Plug & Play Monitoring for Distribution Substations," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 624-629.  
doi: 10.1109/ICIT45562.2020.9067226  
Abstract: New decentralised and mostly renewable energy sources and the increase in the e-mobility domain cause new challenges for the grid infrastructure. Especially, the low-voltage grid will be affected. A necessary step towards a resilient operation of future grids is to equip the low-voltage grid with sensors, which will provide sufficient monitoring data for the implementation of intelligent planning and control algorithms. Since the infrastructure is very durable and not all distribution substations are equipped with sensors, this paper presents a Plug & Play monitoring system that can be easily integrated into existing substations. The system consists of a local control box and fully wireless, energy self-sufficient current sensors. The sensors are attached to the individual phases of secondary feeders, measure the line current and transmit the data to the controlbox using a time synchronized wireless communication protocol. The controlbox measures the secondary voltage directly, calculates all relevant power values of the substation and transmits them to a backend (e.g., SCADA). In order to demonstrate the functional principle of the proposed monitoring system, a prototype of the current sensor and the backend is presented in this paper.  
keywords: {Current measurement;Sensors;Monitoring;Voltage measurement;Battery charge measurement;Current transformers;Substations;Smart Grid;Plug and Play;Monitoring Systems;Wireless Time Synchronisation;Energy Harvesting;Power Quality;Low-voltage Grid},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067226&isnumber=9067096>  
  
F. Díaz, M. Rivera, H. Chávez and P. Wheeler, "Present and Future of the Chilean Electrical Grid," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 630-635.  
doi: 10.1109/ICIT45562.2020.9067249  
Abstract: The technological development of Chile has lead to a major energy demand. This paper presents a description of the current reality of the Chilean electricity sector and its future. The vision and its advancements in Chile are matter of observation to develop a clearer picture for maintaining and increasing the penetration of renewables towards global decarbonification and climate change mitigation.  
keywords: {Companies;Hydraulic systems;Integrated circuit interconnections;Renewable energy sources;Oils;Substations;Power generation;Renewable Energy;Electrical system;Distributed Generation;Smart Grid;Chile},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067249&isnumber=9067096>  
  
"SIP - Signal and Image Processing and Computational Intelligence," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 636-638.  
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H. Qin, S. Yin, T. Gao and H. Luo, "A Data-driven Fault Prediction Integrated Design Scheme Based on Ensemble Learning for Thermal Boiler Process," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 639-644.  
doi: 10.1109/ICIT45562.2020.9067216  
Abstract: As modern industrial systems are becoming more and more sophisticated, the reliability and safety issues of these complex industrial systems have become the most critical parts in system design. Data-driven fault diagnosis and fault prediction technology play important roles in the field of fault prediction and health management of complex industrial systems. This paper studies the machine learning aided data-driven fault prediction techniques. Three kinds of machine learning algorithms, i.e. random forest (RF), lasso regression (Lasso) and support vector machine regression (SVR), are employed to predict the fault related key performance indicator (KPI) of the thermal boiler system. The boiler's monitoring data is preprocessed, after which the characteristic variables are selected with the algorithm of RF and support vector machine-recursive feature elimination (SVM-RFE). The stacking algorithm is finally used to combine the three basic models. The proposed prediction model performs much better in fault prognosis in comparison with the original prediction model.  
keywords: {Predictive models;Prediction algorithms;Boilers;Forestry;Data models;Radio frequency;Stacking;Fault Prediction;Stacking;Lasso Regression;Random Forest;Support Vector Machine Regression},  
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H. Haimovich, D. Marelli and D. Sarlinga, "A Signal Processing Method for Metal Detection Sensitivity Improvement in Balance-Coil Metal Detectors for Food Products," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 645-651.  
doi: 10.1109/ICIT45562.2020.9067312  
Abstract: Food products containing a high level of moisture generate detection signals on their own when passing through a balance-coil metal detector, even when not contaminated with metal. Metal detection methods for these cases necessarily involve signal processing strategies. Standard versions of these strategies usually take only the values of the detection signals into account but not their shape, i.e. not the order in which these values appear. In this paper, we develop a method able to improve metal detection sensitivity by appropriately taking detection signal “shape” into account. This requires a strategy for achieving synchronization between the signals corresponding to different items passing through the detector.  
keywords: {Metals;Detectors;Calibration;Standards;Food products;Probes;Signal processing;Balance coil metal detectors;conveyed food products;signal processing;metal detection sensitivity},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067312&isnumber=9067096>  
  
R. Marani, D. Palumbo, G. Bono, G. Cicirelli, U. Galietti and T. D'Orazio, "Analytical Model Approximation for Defect Classification in Fiberglass Composites Inspected by Long-Pulse Thermography," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 652-657.  
doi: 10.1109/ICIT45562.2020.9067198  
Abstract: This paper presents a complete pipeline for automatic detection and classification of defects within composite laminates inspected by active IR thermography. Specifically, long-pulse thermography is proposed for nondestructive evaluation of samples made of Glass Fiber Reinforced Polymer (GFRP). A model approximation based on exponential functions is used to achieve an efficient representation of temperature decays at the surface of the samples. At the end of the pipeline, several decision forests are implemented to process input features and label corresponding areas among three classes of interest: sound regions, surface defects, and in-depth discontinuities. Results prove that the proposed methodology performs with good accuracy also in case of inspection of GFRP samples tested by long-pulse thermography.  
keywords: {Heating systems;Testing;Forestry;Cameras;Cooling;Surface waves;Inspection;quality control;long-pulse thermography;GFRP;decision forest},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067198&isnumber=9067096>  
  
A. Ovalle, A. Hably and S. Bacha, "Evolution representation with limited hosting capacities: A comparison between MSD and IEED," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 658-662.  
doi: 10.1109/ICIT45562.2020.9067274  
Abstract: This paper presents a comparison between Mixed strategist dynamics (MSD) and a generalized evolutionary game dynamics known as Intersection Escort Evolutionary Dynamics (IEED). Through illustrative examples, it will be shown that IEED exhibits a computational advantage over MSD especially for high order and non-homogeneous constraints for the variables of the problem under study.  
keywords: {Sociology;Statistics;Vehicle dynamics;Trajectory;Biological system modeling;Games;Mathematical model},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067274&isnumber=9067096>  
  
O. Bolkhovskaya, A. Maltsev, V. Sergeev, W. Keusgen and M. Peter, "Investigation of Theoretical limits for Unconditional AoA Estimations in multi-element antenna arrays by simulations," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 663-668.  
doi: 10.1109/ICIT45562.2020.9067150  
Abstract: In this paper, we thoroughly investigate the performance of unconditional angle-of-arrival AoA estimation in multi-element antennas for a finite number of samples. Two AoA estimation algorithms are applied: a direct iterative algorithm for searching the maximum likelihood (ML) estimate and a three-step algorithm using the sample covariance matrix eigenvalue decomposition at the first step and the least-square (LS) method to improve the estimate at the next steps. Two configurations of antenna systems are considered: uniform linear array (ULA) and uniform circular array (UCA). It is shown that for the proposed algorithms and considered antenna configurations, the accuracy of AoA estimation for large SNR reaches a theoretical limit that depends only on the sample size N. In low SNR region the iterative algorithm at 35 % -50 % outperforms the accuracy of the three-step algorithm. The joint detection-estimation schemes for the considered estimators and antenna arrays were investigated. It was shown that the detection characteristics of these schemes are very close for the given numbers of antenna elements and samples.  
keywords: {Antenna arrays;Signal to noise ratio;Maximum likelihood estimation;Antenna theory;Iterative methods;angle-of-arrive estimation;multi-element antenna arrays;joint detection-estimation algorithms;ULA;UCA},  
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D. Pechebovicz et al., "Plants recognition using embedded Convolutional Neural Networks on Mobile devices," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 674-679.  
doi: 10.1109/ICIT45562.2020.9067289  
Abstract: In this work we propose a mobile application capable of recognizing Brazilian medicinal plants to be used by universities, students that have not previous contact with the species and professionals working on health centers. We describe the database generation based on the Brazilian Ministry of Health list of medicinal and common toxic plants. We also implement artificial intelligence techniques to perform the recognition task using a class of convolutional neural networks (CNN) focused on lowering the computation resource necessary to run deep learning tasks and also optimizing the execution of the architectures on embedded and mobile devices.  
keywords: {Computer architecture;Agriculture;Plants (biology);Animals;Convolutional neural networks;Kernel;Training;Image Classification;Convolutional Neural Networks;Embedded Applications;Plant Recognition},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067289&isnumber=9067096>  
  
O. Gutierrez-Navarro, D. U. Campos-Delgado, R. A. C. Peñuelas and C. U. H. Segura, "Quantitative and non-destructive evaluation of ground beef based on multi-spectral imaging," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 680-685.  
doi: 10.1109/ICIT45562.2020.9067300  
Abstract: The quality of meat-based products is usually tested by subjective and analytical methods. There are laboratory tests which can accurately estimate the content of a sample. Yet, they imply the sample destruction. In addition, they are time consuming and not suitable for industrial applications. Spectral unmixing is wide popular in remote sensing and biomedical applications for a quantitative analysis of an image. In this study, we apply an optical characterization of a ground-beef sample by blind linear unmixing. We prepare samples of ground beef with fixed fat/protein content. The samples are employed to evaluate the characterization provided by linear unmixing of multi-spectral data. We use an eight-band multi-spectral camera and halogen lamps as illumination source. A constrained quadratic optimization algorithm is employed to estimate end-members and their abundances in the sample. The linear unmixing was applied to estimate four end-members and their abundances in the ground beef samples. These abundances match the visual characteristics of the sample such as positions with high concentration of fat.  
keywords: {Fats;Cameras;Image color analysis;Pigments;Visualization;Remote sensing;spectral unmixing;multispectral imaging;nondestructive evaluation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067300&isnumber=9067096>  
  
G. Correia and R. Cortesão, "Semi-Automatic Tool for Dynamic Contour Tracking in Image-Guided Ultrasound Procedures," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 686-691.  
doi: 10.1109/ICIT45562.2020.9067109  
Abstract: Tracking tools for target structures in ultrasound imaging are a crucial point in the development of semiautonomous image guided procedures. This paper presents an algorithm for semi-autonomous target-structure tracking, which uses a parametric active contour model with a Fourier descriptor formulation. The algorithm is tested in a soft real-time scenario, and its robustness is analysed w.r.t. probe translation and rotation, including also target structure deformations. In terms of temporal performance, the algorithm implemented in MATLAB has shown the ability to operate easily at 25 fps when coupled with an ultrasound probe, showing however capability to reach 40 fps when tested as a standalone algorithm.  
keywords: {Active contours;Visual servoing;Mathematical model;Computational modeling;Ultrasonic imaging;Imaging;Ultrasound imaging;Image-guided procedures;Visual servoing;Active contours;Image moments},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067109&isnumber=9067096>  
  
S. Baek and C. Lee, "Single Image Super-Resolution Using Frequency-Dependent Convolutional Neural Networks," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 692-695.  
doi: 10.1109/ICIT45562.2020.9067323  
Abstract: In this paper, we propose a single image super-resolution (SR) method based on frequency-dependent training of convolutional neural networks. Several researchers have focused on the reconstruction of super-resolution images by training a single convolutional neural network. In the proposed method, we divided the input images into three sub-frequency groups and then trained a convolutional neural network for each sub-frequency group. Then, the final output images were reconstructed by combining the SR images from the multiple networks. Experimental results show that the proposed training method produces promising performance.  
keywords: {Training;Image resolution;Convolutional neural networks;Signal resolution;Computer vision;Degradation;Conferences;single image super-resolution;convolutional neural network;sub-frequency training},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067323&isnumber=9067096>  
  
S. Premebida et al., "Sunspot behavior forecast using neural networks approaches," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 696-700.  
doi: 10.1109/ICIT45562.2020.9067206  
Abstract: The study of solar activity is of great interest for the recognition of its influence on the earth. A great step in astronomy is the prediction of solar activity, allowing better preparation for study and recognition of future solar and terrestrial events. In our research we used Neural Networks models to predict sunspot numbers based on solar activity recorded between 1818 and 2019. Solar activity data were taken from the Solar Influences Data analysis Center (SIDC) website and Sunspot Index and Long-term Solar Observations (SILSO). Results show a high potential of this processing that become a competitive approach for the sunspots prediction.  
keywords: {Neurons;Predictive models;Testing;Biological neural networks;Magnetic resonance imaging;Computer architecture},  
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doi: 10.1109/ICIT45562.2020.9067118  
Abstract: This paper aims to assess the ability of bidirectional chargers for Electric Vehicles to provide ancillary services for Smart Grids, such as frequency regulation and active filtering. The charger is composed of a conventional AC/DC converter and a three-phase Dual Active Bridge DC/DC converter with an adaptive control that takes into account the change in the battery voltage and the charging/discharging power. These ancillary services are tested using Simulink/Simscape and verified in a real-time environment via Hypersim.  
keywords: {Batteries;Frequency control;Topology;Smart grids;Filtering;Voltage control;Delays;Dual Active Bridge;Smart Grid;Electric Vehicles;Active Filtering;Frequency Control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067118&isnumber=9067096>  
  
M. Okon, J. Opferkuch and C. Endisch, "Modular Gear Transmission Model for Analyzing Production Tolerances in Electric Drivetrains," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 709-716.  
doi: 10.1109/ICIT45562.2020.9067240  
Abstract: Manufacturing tolerances can have noticeable impacts on the operating behavior of an end product. In the field of electric automotive drivetrains, the mechanical transmission is an essential part that is affected by tolerances. This work presents an approach to model gear transmissions via modular components for dynamics analyses considering tolerances. The model structure consists of components which represent gearwheels, carriers, bearing dynamics and gear mesh dynamics. For simulations, a planetary gear transmission model is established which includes time-varying gear mesh stiffnesses based on meshing geometry. Both an exclusively mechanical simulation with an ideal rotational motion source and electromechanical simulations using a model of a voltage/frequency-controlled electrical machine are performed. The model approach is validated with help of the resulting rotational motion curves, bearing forces and frequency spectra of gear mesh forces, input torque at sun gearwheel side and electrical current. In this context, plausibility of the results is assessed by comparison with existing literature.  
keywords: {Gears;Mathematical model;Numerical models;Vehicle dynamics;Force;Planets;Dynamics;Electric drivetrain modeling;multidomain simulation;modular gear transmission model;gear mesh dynamics},  
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D. Iannuzzi, M. Pagano, P. Franzese and C. Roscia, "On-board Energy Storage Systems based on Lithium Ion Capacitors for LRT Energy Saving: Optimization Design Procedure," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 717-722.  
doi: 10.1109/ICIT45562.2020.9067293  
Abstract: Storage technologies devices are very interesting solutions for improving energy saving and guaranteeing contemporaneously to enhance the electrical characteristics of Light Rail Transit (LRT) systems. Onboard Energy Storage System based on Lithium Ion Capacitor (LiC) devices represent a viable engineering solution for energy saving optimization. The authors suggest a multi-objective design optimization procedure based on catenary and storage power losses minimization. A test characterization of ESS has been presented in order to use the better appropriate modeling of LiC for the examined case study. The numerical simulation allows to confirm the feasibility of the proposed design procedure.  
keywords: {Voltage measurement;Substations;Light rail systems;Optimization;Rails;Discharges (electric);Resistance;Optimal design procedure;Lithium Ion Capacitor;Energy storage system;Light Rail Transit},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067293&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067111  
Abstract: The ongoing trend towards electro mobility is radically changing automotive industry. However, the limited battery electric range and the resulting restrictions on personal mobility present a major customer concern that must be tackled by car manufacturers. Especially on longer trips, the time required for charging stops is troublesome. This research presents an approach that combines data on road, traffic and available charging infrastructure for a desired route to plan a time optimal trip for an electric vehicle. For this purpose, charging decisions, charging times and intentional speed reduction on highways are the degrees of freedom for the optimization. The underlying vehicle and consumption model was validated in a previous study and used to formulate a mixed integer linear program which minimizes the estimated consumption. Within an elaborate simulative study, the optimization results are compared to a heuristic baseline strategy which indicates reasonable computation time and significant reduction of the resulting trip time on trips that exceed the range of the considered vehicle.  
keywords: {Batteries;Trajectory;Planning;Routing;Charging stations;Vehicles;Road transportation},  
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L. E. Venghi, F. Aguilera, G. N. Gonzalez, P. M. de la Barrera and C. H. De Angelo, "Effects of open-switch faults over speed sensor fault-tolerant scheme for electric traction drive," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 731-736.  
doi: 10.1109/ICIT45562.2020.9067326  
Abstract: In this work, the effects of open-switch faults over speed sensor fault-tolerant scheme for electric traction drive are analyzed. The fault-tolerant scheme uses a sliding mode observer to generates a fault diagnostic signal and to estimates the rotor speed of an induction motor. Through simulation results, the effects of faults in an electric drive and their interaction on the dynamic performance of an electric vehicle are analyzed.  
keywords: {Fault tolerance;Fault tolerant systems;Circuit faults;Observers;Rotors;Wheels;Aerodynamics;Electric vehicle;sliding mode observer;fault tolerance;open-switch;VSI},  
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K. O. Mtepele, D. U. Campos-Delgado, A. A. Valdez-Fernandez and P. R. Martínez-Rodríguez, "Model-Based Fault Diagnosis of 3-Phase CHB-nL Converters in Power Filter Applications," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 737-742.  
doi: 10.1109/ICIT45562.2020.9067164  
Abstract: This paper introduces a model-based fault detection and isolation (FDI) strategy for an open-circuit fault (OCF) in the power switches of a 3-phase cascaded H-bridge (CHB) converter, in the generalized case of n-levels (CHB-nL). A 3-phase shunt active power filter (SAPF) application has been considered in this work. The proposed scheme consists of two stages: the first one is fault detection, which will be in charge of indicating which phase is faulty in the CHB-nL converter, and the second one is fault isolation. The fault detection stage is implemented by a sliding-mode observer in the α -ß -coordinates based on an additive modeling perspective of the faults. The isolation stage will identify the exact failing pair of switches within the H-bridge per phase. To achieve fault isolation, proportional-integral observers are proposed to estimate the DC fault profiles. Simulation results using a 3-phase 7-levels CHB (CHB-7L) converter with N=3 bridges are presented to assess the performance of the suggested FDI scheme. Our evaluation includes nominal conditions and a robustness test to step changes on the load side.  
keywords: {Circuit faults;Fault detection;Observers;Mathematical model;Fault diagnosis;Capacitors;Additives},  
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"ACGCIPQREI Advanced Control of GridConnected Inverters for Power Quality and Renewable Energy Integration," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 743-744.  
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B. Arabsalmanabadi, P. Porras, H. Arab, S. Dufour and K. Al-Haddad, "Analytical Design Study of Spiral Circular Coils for Efficient Magnetic Resonant Coupling Power Transmission in EV Chargers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 745-750.  
doi: 10.1109/ICIT45562.2020.9067189  
Abstract: Wireless Power Transmission (WPT) systems provide a technical solution for EV range issue of EV chargers by rapid in-station or dynamic charging of batteries. Although, hot debates concerning the optimization of the structural design of coils and the maximum system efficiency still remain. To have a maximum energy efficiency, a compromise with the switching frequency and coils design is required. In this paper, an optimum algorithm is proposed for designing Magnetic Resonance Power Transmission (MRPT) system parameters to operate in zero voltage switching (ZVS) state and far from bifurcation phenomenon by tuning the series-series compensator. A step by step theorical study of the proposed algorithm is described and executed in Matlab.  
keywords: {Coils;Magnetic resonance;Zero voltage switching;Couplings;Mathematical model;Inductance;Magnetic Resonance Power Transmission Systems;Electric Vehicle Chargers;Series-Series Compensators;Zero Voltage Switching technique;Circuit Designing},  
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R. Khawaja, F. Sebaaly and H. Y. Kanaan, "Design of a 7-Level Single-Stage/Phase PUC Grid-Connected PV Inverter with FS-MPC Control," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 751-756.  
doi: 10.1109/ICIT45562.2020.9067338  
Abstract: Multilevel, transformer-less inverters are becoming more and more a subject of interest in grid connected photovoltaic system due to their low cost and high efficiency features. However, most of the designed grid tied systems show more than one stage conversion process to inject the amount of power generated to the grid. Mainly, a DC-DC conversion stage is always requested between the Photovoltaic (PV) panel and the inverter. In this paper, a single-stage grid connected design based on seven level packed U-cell inverter controlled by a finite-set model predictive algorithm with a maximum power point tracking capability is presented as a competitive single-stage/phase grid-connected topology. The overall design is less complex compared to existing topologies where a maximum power point operation of the PV system is well achieved without the use of a boost converter. A predictive algorithm takes in action of the inverter control. Simulation results in MATLAB/SIMULINK are presented to validate the proposed design in both constant and variable irradiation conditions.  
keywords: {Inverters;Voltage control;Capacitors;Mathematical model;Switches;Maximum power point trackers;Topology;PV system;Grid connected;Packed U-Cell Inverter;Model Predictive Control;Single Phase/Stage Inverter;MPPT;Perturb and Observe},  
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M. Barragán-Villarejo, J. M. Mauricio, J. C. Olives-Camps, F. J. Matas-Díaz, F. de Paula García-López and J. M. Maza-Ortega, "Harmonic and Imbalance Compensation in Grid-Forming VSC," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 757-762.  
doi: 10.1109/ICIT45562.2020.9067175  
Abstract: The massive integration of distributed energy resources is strongly linked to the development of voltage source converters responsible for connecting them to the grid. These will have to provide a series of services that facilitate their integration into the future distribution network. Among them, it is important to highlight the need to improve the wave quality of the voltages which can be distorted by the increase of nonlinear and unbalanced loads in the system. This paper presents a control strategy for grid-forming voltage source converter able to compensate harmonics and imbalances of the voltages at the point of common coupling. The objective of the controller is to generate a balanced three-phase voltage with a given amplitude and frequency for any type of load or generation connected to the power converter. The proposed control algorithm works over the rotating axes adding resonant structure tuned at the specific harmonic to be eliminated in the outer voltage control loop. Moreover, a systematic methodology is presented to compute the gains of the controller. A laboratory testbed with different type of loads is used to validate the proposed algorithm. The experimental results demonstrate the effectiveness of the proposal by achieving low levels of harmonic distortion and imbalances in steady-state.  
keywords: {Voltage control;Harmonic analysis;Electric current control;Voltage source converters;Power distribution control;Power quality;Power generation control;voltage source converter;grid-forming;nonlinear and unbalanced system;resonant controller},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067175&isnumber=9067096>  
  
Y. Wang, Z. Zhang, C. Garcia, J. Rodríguez and R. Kennel, "Robust Predictive Control of Grid-Side Power Converters for PMSG Wind Turbine Systems with Stability Analysis," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 763-768.  
doi: 10.1109/ICIT45562.2020.9067307  
Abstract: Renewable energy plays an increasingly significant role in the power generation process. Wind energy, in particular, has brilliant prospects, especially high-power wind energy. The three-level neutral-point-clamped (3L-NPC) converter for power transformed into the grid has proven to be a promising and effective configuration. For this topology, finite control set model predictive control (FCS-MPC) is an effective control option. However, the performance of FCS-MPC, like most model based control schemes, will deteriorate when system parameter (in particular, the inductance of grid side filters) varies. In this work, we propose a robust FCS-MPC scheme with revised predictions. This proposed robust FCS-MPC outperforms the classic scheme at both normal and parameter mismatched conditions, which has been validated experimentally for such systems with a fully FPGA based real-time hardware. Besides, the proposed method enlarges the range of the stability of the control method. The stability of the proposed scheme is derived theoretically and proven to be better in comparison with classic FCS-MPC.  
keywords: {Robustness;Inductance;Voltage control;Stability analysis;Mathematical model;Predictive control;Topology;Three-level neutral-point-clamped converter;finite control set model predictive control;robust control;stability derivation;FPGA},  
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"AI40 Agro Industry 4.0," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 769-770.  
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L. Martínez Rau, J. O. Chelotti, S. R. Vanrell and L. L. Giovanini, "Developments on real-time monitoring of grazing cattle feeding behavior using sound," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 771-776.  
doi: 10.1109/ICIT45562.2020.9067192  
Abstract: Estimating forage intake and monitoring the foraging behavior of grazing livestock are difficult tasks. Detection and classification of jaw movements are very useful to obtain that information. In a similar way, the monitoring and analysis of long-term activities such as rumination and grazing provide useful insight. Several works have demonstrated that acoustic monitoring is an adequate way to analyze ruminant feeding behavior. In this work, we present a complete system for monitoring ruminant foraging behavior. As components of such a system, a review about two own methods based on the analysis of acoustic signals is included: i) a short-term analysis system that automatically detects and classifies jaw movements, and ii) a long-term analysis system for the recognition of grazing and rumination activities. Both systems use simple concepts and tools derived from signal processing and pattern recognition areas. A description of an ad-hoc electronic platform is also included.  
keywords: {Cows;Monitoring;Feature extraction;Classification algorithms;Acoustics;Pattern recognition;feeding behavior;signal processing;pattern recognition;embedded system},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067192&isnumber=9067096>  
  
F. Vique, H. Marichal and L. Steinfeld, "Inline mastitis detection system measuring the electrical conductivity of quarter milk," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 777-784.  
doi: 10.1109/ICIT45562.2020.9067172  
Abstract: Dairy profitability depends on the quantity and quality of the produced milk. Bovine mastitis is the infection of udder tissues of cows that reduces both, and therefore it causes considerable economic damage to milk producers. Nowadays, the most widely adopted method to detect mastitis is by determining the somatic cell count per milliliter of milk. However, it requires qualified personnel and sometimes the results take a long time to be available, hampering an effective solution. The electrical conductivity of the milk could also be used, but if the test is done manually by an operator neither is effective, since affects the normal operation of the parlour. In this work we propose a mastitis detection system based on the measuring of the electrical conductivity of the milk of each quarter during the milking. A new milking claw is designed to include the conductivity traducers inside it, which are connected to the rest of the measuring unit. As a result, the only necessary modification to the milking machine is to replace the original milking claw with the new one. The system also includes a central unit to process conductivity samples sent by each measuring unit to determine if a cow has mastitis or not. A prototype is successfully tested in field, obtaining a precision of 65% and a recall of 64% for infected cows, approaching to the state of the art. Nevertheless, our approach is, to the best of our knowledge, the first proposal that allows a cost-effective solution since it can be integrated to existing milking machines and capable of issuing early warnings.  
keywords: {Dairy products;Conductivity;Cows;Conductivity measurement;Temperature measurement;Temperature sensors;Mathematical model;component;formatting;style;styling;insert},  
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N. C. Iglesias, P. Bulacio and E. Tapia, "Internet of Agricultural Machinery: Integration of heterogeneous networks," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 785-790.  
doi: 10.1109/ICIT45562.2020.9067214  
Abstract: Recently, the introduction of Internet of Things (IoT) concept has promoted new applications in the agricultural domain, powering the development of Agriculture 4.0. One of the major issues is the incompatibility of devices and protocols. In this work, we address the interoperability between Electronic Control Units (ECUs) on the agricultural machinery by means of developing of a Network Interconnection Units (NIU). The NIU interconnects two heterogeneous physical networks, one based on CAN 2.0 B standard, and the other one based on IEEE 802.15.4 standard by means of the ISO 11783 protocol implementation with the purpose of extending this last protocol for wireless applications. The proposed NIU was implemented using a general purpose development board in correspondence with the rapid prototyping and constrained devices concepts of IoT. NIU performances were evaluated and analyzed in terms of ISO 11783 network requirements.  
keywords: {IEEE 802.15 Standard;Protocols;ISO Standards;Agricultural machinery;Wireless communication;Logic gates;ISO 11783;IEEE 802.15.4;ISOBUS;IoT;Agriculture 4.0;Gateway;NIU},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067214&isnumber=9067096>  
  
J. A. Redolfi, S. F. Felissia, E. Bernardi, R. G. Araguás and A. G. Flesia, "Learning to Detect Vegetation Using Computer Vision and Low-Cost Cameras," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 791-796.  
doi: 10.1109/ICIT45562.2020.9067316  
Abstract: A problem of current agriculture is the large amount of agrochemicals used to boost production due to their cost and the environmental pollution they cause. A partial solution to this problem consists in developing selective spraying techniques through the measurement of a green index that allows the selection of the precise amount of pesticide to be applied according to the specific conditions of each part of the field. Some of the problems of the existing systems are the inability to discriminate between types of vegetation and to pinpoint its location, since they only detect general patches of vegetation. In this work, we introduce a system prototype capable of measuring the presence of vegetation in an area using low-cost devices combined with current computer vision techniques. The system allows to generate a mask with the presence of vegetation in a certain area and it is also capable of distinguishing between different materials unlike current methods, which only allow to distinguish between green and non-green areas. The presented method opens the door to future research which can allow distinguishing between crops and weeds to make an even more selective application. The output of the system can be used also to design another type of weeding method that is not based on the application of agrochemicals.  
keywords: {Cameras;Vegetation mapping;Agriculture;Green products;Sensors;Prototypes;Computer vision;Precision Agriculture;Selective Spraying;Computer Vision;Fisher Vector},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067316&isnumber=9067096>  
  
N. Acosta, N. Barreto, P. Caitano, R. Marichal, M. Pedemonte and J. Oreggioni, "Research platform for cattle virtual fences," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 797-802.  
doi: 10.1109/ICIT45562.2020.9067313  
Abstract: Prior work in virtual fences has proposed different schemes to keep cattle confined within a remotely configured perimeter. These techniques share a common pattern that consists in placing an electronic device in the animal capable of applying a stimulation when it approaches the pre-established limits. The method of stimulation most widely used is electric shocks. This work proposes a solution compatible with animal welfare, which avoids electric shocks, based only on sound and tactile stimuli (using a buzzer and a vibrating motor, respectively). For this, a system was developed consisting in an electronic device that is placed on the animal's neck, and has the capacity to stimulate and send information wirelessly; a central server that is able to receive, process and store that information; and a graphical user interface, where the animal's location can be visualized and several parameters can be configured to evaluate different virtual confinement techniques. Preliminary tests performed on animals suggest that the stimuli used is aversive, so it is inferred that they could achieve their goal after a period of training. The research on the effectiveness of the proposed confinement techniques using our platform should be carried out in a next stage.  
keywords: {Servers;Global Positioning System;Data communication;Logic gates;Cows;Microcontrollers;animal confinement;cattle tracking;animal welfare},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067313&isnumber=9067096>  
  
"ATAEMSSH Advanced Techniques Application for Energy Management Systems and Smart Home," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 803-804.  
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M. Khoshlessan, B. Fahimi and M. Kiani, "A comparison between Machine learning algorithms for the application of micro-grids Energy management," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 805-809.  
doi: 10.1109/ICIT45562.2020.9067203  
Abstract: Advanced micro-grids are envisioned to be a critical part of future smart grids due to their local intelligence and capability on hosting distributed energy resources. To control a community of micro-grids so that the energy is distributed in a proper manner and reliability in supplying critical loads is increased, a smart decision making should be applied to the system. By using machine learning algorithms, the system can make intelligent, precise, and fast decisions leading to achieving the above mentioned goals. In this paper, five machine learning algorithms are applied to a set of data related to a community of three micro-grids. The data set including test data and training data is obtained based on grid voltage, weather, state of charge (SOC) of the storage system in both micro-grid and it's neighboring unit, and time of the day. The modes of operation are achieved from rational decisions that brings about a wide range of energy distribution from available sources into the most preferable loads. Random Forests, Decision Tree, Logistic Regression, SVM, and Gradient Boosting are the five various algorithms used to manage the distribution of energy and will be compared.  
keywords: {Machine learning algorithms;Machine learning;Meteorology;Support vector machines;Smart grids;Decision trees;Data models;machine learning algorithm;support vector machine;decision tree;random forests;logistic regression;and gradient boosting},  
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L. N. Santos et al., "A Distributed Generation Manager with support for Distributed Network Operator Commands," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 810-815.  
doi: 10.1109/ICIT45562.2020.9067315  
Abstract: The distributed generation management (DGM) is becoming mandatory to allow the distributed network operator (DNO) deal with several issues in the grid with distributed generation units. In this work a solution is proposed for the management of multiple photovoltaic inverters inside a microgrid. This paper proposes a supervisory unit for the DGM in order to deal with several conditions of inverters operation inside grid. A secure communication system using IEC 61850/SunSpec protocols is applied such that the DNO can effectively command the microgrid inverters as a single unit of dispatch. Moreover, in the proposed approach all inverters are optimized to work in different dispatch modes: MPPT, limited active power mode, power factor correction mode and reactive power dispatch. The proposed system architecture, the distributed generation manager as well as the Supervisory Unit are detailed. The paper presents the results from simulations and from the Raspberry Pi 3 hardware implementation with real-time dSPACE based microgrid emulator.  
keywords: {Inverters;Reactive power;Microgrids;Distributed power generation;Optimization;Smart meters;Communication systems;Distributed Generation Control;Aggregation},  
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V. E. S. Barbosa, E. G. Carati, J. P. da Costa, R. Cardoso, C. M. O. Stein and Z. L. I. Nadal, "Event Management Layer for Distributed Generation Photovoltaic Inverters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 816-821.  
doi: 10.1109/ICIT45562.2020.9067142  
Abstract: This paper proposes a multi layer management approach for power inverter control of grid connected photovoltaic systems. Initially, an event management model is derived from the photovoltaic inverter unit, in which the set of uncontrollable events is accounted for as perturbed terms added to the controllable nominal set model. Then, a discrete-event approach design procedure that guarantees the PV system stability under irradiance solar uncertainties and disturbances at the grid side is presented in detail. It is demonstrated that a very fast dynamic behavior can be obtained with the proposed inverter management layer, which improves the transient response of the grid connected PV system, especially under conditions of fast changes of the solar irradiance and voltage dips resulting from network faults, which can be helpful to match the new grid codes. Experimental results in Hardware-in-the-loop are given to support the theoretical analysis and to illustrate the performance of grid connected PV inverter with the proposed management approach.  
keywords: {Inverters;Photovoltaic systems;Control systems;Standards;Automata;Pulse width modulation;Distributed generation;Discrete events;Microgrids;Smart inverter},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067142&isnumber=9067096>  
  
A. Kirimtat, O. Krejcar and M. F. Tasgetiren, "Evolutionary Computation for the Development of Smart Floating Cities," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 822-828.  
doi: 10.1109/ICIT45562.2020.9067105  
Abstract: Prior to the emergence of both terms “smart city” and “floating cities”, the human population has already increased and land scarcity has begun to be grasped by the humanity across the world. Therefore, as a first challenge, the concept of smart city has been extended to the scientific era as a novel solution by researchers. Thereafter, the floating city concept has been introduced in the literature by a couple of scientists in order to make provision against rising sea levels. On the other hand, designing a city is known as a complex design problem among engineers, architects and designers, thus evolutionary algorithms could be used to solve this complicated problem by optimizing inhabitants' demands. We, in this research, compare the results of two different evolutionary algorithms namely as Self-adaptive Differential Evolution (DE) and Self Adaptive Continuous Genetic Algorithm with Differential Evolution (DE) by optimizing two conflicted objective functions visual comfort and accessibility between the nodes in the proposed smart floating city.  
keywords: {Sociology;Statistics;Linear programming;Smart cities;Evolutionary computation;Visualization;evolutionary algorithms;floating cities;smart cities;multi-objective optimization},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067105&isnumber=9067096>  
  
"ATCTMC Advanced Topologies and Control Techniques for Multilevel Converters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 829-830.  
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S. Cáceres, F. Rojas, K. Barbosa, T. De la Cuadra, M. Diaz and G. Gatica, "Fault Detection in Triple Star Bridge Cell Modular Multilevel Converter using Sliding Mode Observer," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 831-836.  
doi: 10.1109/ICIT45562.2020.9067190  
Abstract: The family of modular multilevel converter is characterized for using several cells to properly face Medium and High voltage range. This high number of semiconductors reduces its reliability. In this paper, a sliding mode observer (SMO) is implemented to continually estimate the current of clusters and voltage of each cell capacitor and directly detect a faulty cell by an open circuit of the semiconductor. A Triple Star Bridge Cell Modular Multilevel Converter (TSBC-MMC) with three cell per cluster for direct conversion of AC to AC voltage have been implemented in PLECs software. Simulation results show the feasibility and an excellent performance of the proposed SMO, which effectively can discriminate the faulty cell among the 27 different cells of the converter without using additional measuring devices.  
keywords: {Observers;Circuit faults;Capacitors;Mathematical model;Fault detection;Insulated gate bipolar transistors;Semiconductor device measurement;Modular multilevel converter (MMC);fault detection and isolation (FDI);sliding mode observer (SMO)},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067190&isnumber=9067096>  
  
L. Tarisciotti, A. Costabeber, M. Díaz and R. Cardenas, "Improved Modular Multilevel Converter topology for low voltage variable speed drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 837-842.  
doi: 10.1109/ICIT45562.2020.9067144  
Abstract: Modular Multilevel Converters (MMC) are becoming increasingly popular for HVDC applications and in medium voltage grids and drives. On the contrary, in high-speed low-voltage drives MMCs are typically not considered a good option due to their relatively low power density. In this paper, a new topology is proposed, enhancing the MMC by coupling upper and lower arm sub-modules via Dual Active Bridge (DAB) converters, leading to a sensible reduction of the sub-module capacitance whilst keeping low control complexity. The resulting topology is applied to a high-speed low voltage permanent magnet drive, analyzing the drive startup and its practical operation. Finally, the theoretical claims are validated with simulation results.  
keywords: {Topology;Capacitors;Low voltage;Capacitance;Bridge circuits;Mathematical model;Power transformer insulation;Modular Multilevel Converter;Dual Active Bridge},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067144&isnumber=9067096>  
  
M. Ahmadijokani, M. Sharifzadeh, M. Mehrasa, F. Sebaaly and K. Al-Haddad, "Modified Level-Shifted PWM Technique With Active DC Capacitors Voltages Balancing for Nine-level Packed E-Cell (PEC9) Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 843-848.  
doi: 10.1109/ICIT45562.2020.9067245  
Abstract: In this paper, a modified Level-Shifted PWM technique is integrated to an active capacitor voltage balancing method to apply for the recent introduced compact single-phase multilevel converter so-called as Packed E-Cell (PEC9) topology. PEC9 is composed of a single main DC source, single auxiliary DC link including two connected capacitors in series as well as six power switch and one back-to-back switch forms bidirectional switch which nine level voltage waveforms is achievable at the output AC terminal. PEC9 benefits the advantages such as reduced component, simultaneous charging and discharging capacitors with redundant states led to have an active capacitors voltage balancing algorithm. The modified Level-Shifted PWM is integrated with active capacitor voltage balancing technique to regulate the capacitor voltage to one quarter of DC input voltage so as PEC generates nine-level voltage waveform. According to the proposed modified Level-Shifted PWM, the appropriate switching states from the redundant states are selected in the specified level which guarantees balancing PEC9 DC capacitors. The proposed modulation technique has been tested on PEC9 using Matlab/Simulink and simulation results validate its excellent performance in active DC capacitor voltage balancing.  
keywords: {Capacitors;Inverters;Switches;Voltage control;Pulse width modulation;Topology;Single DC source compact Multilevel inverter;PWM techniques;Level Shifted PWM;Packed E-Cell;PEC9;Active Capacitor Voltage Balancing},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067245&isnumber=9067096>  
  
M. Sharifzadeh, M. Babaie, M. Mehrasa, G. Chouinard and K. Al-Haddad, "Optimized SHE-PWAM with Maximum Harmonic Elimination and Minimum Switching Frequency for PEC9 Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 849-853.  
doi: 10.1109/ICIT45562.2020.9067247  
Abstract: This article introduces an Optimized SHE-Pulse Width and Amplitude Modulation (OSHE-PWAM) for single-DC source, single-phase nine-level Packed E-Cell (PEC9) to suppress maximum harmonic while switching frequency is minimized. PEC9 is a developed compact multilevel inverter based on the horizontal extension of capacitors to provide single auxiliary DC-bus and effective charging and discharging states for active capacitor voltage balancing. Based on the proposed OSHE, both switching angles and DC input voltage amplitude are considered as variable in the conventional SHE equations and new equations are developed to deal with maximum harmonic elimination. On the other hand, OSHE also handles capacitor voltage balancing by defining a symmetrical preprogramed output voltage waveform for establishing SHE equations. Simulation results are attained by Matlab-Simulink and confirm the excellent operation of the OSHE-PWM obtaining maximum harmonic elimination and achieving capacitor voltage balancing in PEC9 inverter while the switching frequency is minimized.  
keywords: {Harmonic analysis;Inverters;Capacitors;Switches;Switching frequency;Mathematical model;Voltage control;Single-DC Source Nine-Level Packed E-Cell (PEC9) Inverter;Optimized Selective Harmonic Elimination-Pulse Width and Amplitude Modulation (OSHE-PWM);Maximum Harmonic Elimination;Capacitor Voltage Balancing},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067247&isnumber=9067096>  
  
M. Babaie, M. Sharifzadeh, M. Mehrasa, G. Chouinard and K. Al-Haddad, "PV Panels Maximum Power Point Tracking based on ANN in Three-Phase Packed E-Cell Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 854-859.  
doi: 10.1109/ICIT45562.2020.9067218  
Abstract: This manuscript introduces a novel Maximum Power Point Tracking (MPPT) technique based on Artificial Neural Network (ANN) to inject harvested electrical power from PV panels to a three-phase stand-alone load using nine-level Packed E-Cell (PEC9) inverter. Instead of using three MPPT algorithms and three duty cycle controllers, the proposed ANN-MPPT technique proposes a single controller to extract the Maximum Power (MP) of three PV panels connected to the three-phase stand-alone PEC9 inverter. PEC9 is a promising multilevel inverters topology which uses least semiconductor switches, capacitors and a single DC source to generate a nine-level quasi-sinusoidal voltage waveform. The proposed three-phase PEC9 inverter control loop has been simulated by MATLAB software where the results show proper power quality, low Common Mode Voltage (CMV) and balanced capacitors voltage with minimum ripple.  
keywords: {Inverters;Maximum power point trackers;Capacitors;Topology;Neurons;Voltage control;Artificial neural networks;Artificial Neural Network;Supervised Training Method;Maximum Power Point Tracking;Packed E-Cell Inverter;Three-Phase Load;PV System},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067218&isnumber=9067096>  
  
R. Razi, M. Pham, A. Hably, S. Bacha, Q. Tran and H. Iman-Eini, "Robust hybrid control of parallel inverters for accurate power-sharing in microgrid," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 860-865.  
doi: 10.1109/ICIT45562.2020.9067116  
Abstract: There are some challenges in control of parallel inverters in high-voltage microgrids such as voltage and frequency deviations, presence of communication links, low reliability, and inaccurate power sharing. This paper proposes a hybrid control method using the impedance-power droop and conventional droop method to cover the problems of both methods as much as possible. In the proposed method, the impedance-power droop acts as the main controller and the conventional droop method is employed as auxiliary controller during startup and transient states. The notable advantages of the proposed method are low virtual impedances, no need for recognition of system parameters, and simple and low calculations. Moreover, the voltage deviation in the steady state is minimized and the frequency deviation is completely eliminated. Finally, the performance of the control method is validated by simulation results. The hybrid method is compared with the both methods individually that shows the superiority of the proposed method.  
keywords: {Impedance;Inverters;Voltage control;Frequency control;Microgrids;Power harmonic filters;Harmonic analysis;Hybrid control;inductive microgrid;impedance-power droop;conventional droop method;parallel inverters;power sharing},  
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S. A. Verne and M. I. Valla, "Three phase multilevel CSI with sinusoidal output voltage and fast dynamic response," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 866-871.  
doi: 10.1109/ICIT45562.2020.9067107  
Abstract: A three-phase current-source multilevel inverter is presented in this work. The stepped current waveform at the output is integrated by a first order capacitor filter and provides quasi-sinusoidal output and fast voltage control. A differential DC-DC chopper feeds the DC bus currents from a single voltage/power supply. A Finite Control-Set Model Predictive Control (FCS-MPC) algorithm modulates the multilevel current to synthesize the reference output voltage and also regulate the current on the auxiliary inductors within both cells of the inverter.  
keywords: {Inverters;Inductors;Voltage control;Capacitors;Induction motors;Choppers (circuits);Torque;Multilevel Converters;Current Source Inverter;Predictive Control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067107&isnumber=9067096>  
  
M. Mehrasa, M. Sharifzadeh, M. Babaie, F. Sebaaly and K. Al-Haddad, "Virtual Admittance Compensator (VAC)-based Control Method for PEC9 Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 872-877.  
doi: 10.1109/ICIT45562.2020.9067222  
Abstract: A proportional-resonance (PR) controller along with virtual admittance compensator (VAC) is proposed in this paper for a grid-connected nine-level Packed E-Cell (PEC9) to enable zero steady state and transient errors for the controlled state variables. In order to present further detailed assessments, the closed-loop system of the proposed control strategy is attained to analyze the effects of the coefficients of PR controller as well as the VAC coefficient under various operating conditions. The grid-connected PEC9 is simulated by Matlab/Simulink environment under load variation to verify the validity of the proposed control strategy.  
keywords: {Inverters;Voltage control;Capacitors;Switches;Steady-state;Admittance;Nine-level Packed E-Cell (PEC9);Grid-Connected Inverter;Proportional-Resonance (PR) Controller;Virtual Admittance Compensator (VAC)},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067222&isnumber=9067096>  
  
"CAV Connected and Autonomous Vehicles," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 878-880.  
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D. L. Ossig, S. A. Speidel and O. Sawodny, "Parameter Uncertainties Influencing Vehicle Lateral Dynamics Steady State Applications," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 881-886.  
doi: 10.1109/ICIT45562.2020.9067166  
Abstract: In this paper, the influence of uncertain model parameters on vehicle lateral dynamics steady states is studied. These steady states are widely used in driver assistant systems and enable highly automated driving functions. A methology for propagating random variables through the single-track vehicle model is presented. The random variables are described using continuous probability density functions. It is shown, that the influence of parameter uncertanties scales differently to different steady states. The effect on the path curvature and the lateral acceleration is highlighted. An example for a fault detection scheme is given and analysed in context of the given uncertainty. The faults that can be detected without violating a given true-positive rate and a given false-positive rate are calculated. The method can be used to quickly identify possible problems arising from uncertain parameters.  
keywords: {Steady-state;Random variables;Probability density function;Vehicles;Vehicle dynamics;Mathematical model;Uncertainty;lateral vehicle dynamics;parameter uncertainties;steady states;path curvature},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067166&isnumber=9067096>  
  
L. Benninger and O. Sawodny, "Traffic Flow Modeling Using Available Cloud-Based Traffic Velocity Information," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 887-892.  
doi: 10.1109/ICIT45562.2020.9067097  
Abstract: Due to a constantly increasing interest in autonomous driving, the development of advanced driver assistance systems plays an important role in automotive industry. Current research activities try to include information on the current traffic situation, for example, to improve predictions or assistant functions and emphasize the need for more accurate traffic data. In this sector cloud services already offer basic information about the traffic state such as the current traffic speed. Since online traffic data is partly incomplete or availability cannot be guaranteed for every position, model-based approaches present an option to overcome this problem. Traffic flow models are a useful tool to reproduce traffic situations given the necessary initial and boundary conditions. Within the scope of this work, online traffic data is used to predict the mean traffic velocity for an upcoming road segment by means of a second-order partial differential traffic model. Using highway detector measurements for validation, it is shown that simulations provide meaningful results for traffic speed calculation. Thus, it is possible to predict traffic states spatially for an upcoming horizon. The benefit of this study is reflected in the ability to simulate traffic scenarios not only offline but also online using cloud-based data and consequently making it deployable for in-vehicle applications.  
keywords: {Detectors;Mathematical model;Data models;Road transportation;Boundary conditions;Predictive models;Radar;traffic flow modeling;partial differential equations;connected vehicles},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067097&isnumber=9067096>  
  
"CVTECS Complex Vector Theory in Energy Conversion Systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 893-894.  
doi: 10.1109/ICIT45562.2020.9067273  
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J. A. Solsona, S. G. Jorge and C. A. Busada, "A nonlinear control strategy for a grid-tie inverter that injects instantaneous complex power to the grid," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 895-900.  
doi: 10.1109/ICIT45562.2020.9067287  
Abstract: A nonlinear controller for a VSC injecting power to the grid is designed. The design is based on instantaneous complex power definition. The proposed strategy results in a complex nonlinear controller where both the real part and imaginary part of the instantaneous complex power track a desired reference. It is assumed that a constant power source feeds the VSC. The input power value is needed for calculating the control law, but in this work a nonlinear observer is used for obtaining estimates of input power value and its time derivatives. In this way, the number of sensors is reduced, improving the reliability. Simulation results showing the good performance of the proposed controller are presented.  
keywords: {Observers;Mathematical model;Reactive power;Steady-state;Simulation;Trajectory tracking;Video recording;VSC;instantaneous complex power;constant power source;nonlinear complex control;observer},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067287&isnumber=9067096>  
  
F. M. Serra, A. Doria-Cerezo, C. H. De Angelo, L. L. Martín Fernández and M. Bodson, "Complex Pole Placement Control for a Three-Phase Voltage Source Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 901-906.  
doi: 10.1109/ICIT45562.2020.9067255  
Abstract: In this work, a complex-valued controller for a three-phase VSC with an LC output filter is proposed. The system is first transformed into its complex representation with the consequent order reduction and simpler analysis. The proposed complex controller places all the poles at desirable locations in the complex plane. Unlike classical controllers with an inner current-control loop and outer voltage-control loop, the proposed controller considers the complete dynamics of the system, thus ensuring the closed-loop stability. Furthermore, the complex representation facilitates the pole placement in the complex plane compared to the real domain. The performance of the proposed controller is validated through simulations and experiments.  
keywords: {Voltage control;Mathematical model;Load modeling;Stability analysis;Tools;Inductance;Inductors;complex control;LC inverter;pole placement},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067255&isnumber=9067096>  
  
"ECTCHPPVS Emerging Converter Topologies and Control for HighPerformance PV Systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 907-908.  
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doi: 10.1109/ICIT45562.2020.9067237  
Abstract: The focus is on bipolar dc microgrids with distributed photovoltaic energy generation. Flyback converter with two outputs is used as a photovoltaic module-level interface into the bipolar dc microgrid of much higher voltage. Sigma-delta modulation is proposed to enable one of the converter outputs for balancing the bipolar dc microgrid naturally. This modulation is synchronous with PWM of the input side power switch that is controlled with duty cycle duration calculated by a maximum power point tracking algorithm. As a result, no PI controllers are required in the proposed control system and, thus, stability is ensured. The proposed concept is verified through numerical simulations in PSIM 11 software.  
keywords: {Microgrids;Switches;Sigma-delta modulation;DC-DC power converters;Modulation;Topology;dc-dc converter;photovoltaic energy;flyback converter;module-level power electronics;sigma-delta modulation;dc microgrid},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067237&isnumber=9067096>  
  
"EESES Energy Efficiency and Sustainability in Electrical Systems," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 915-916.  
doi: 10.1109/ICIT45562.2020.9067292  
Abstract: Start of the above-titled section of the conference proceedings record.  
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F. J. T. E. Ferreira, A. F. F. Duarte and F. J. P. Lopes, "Experimental Evaluation of a Novel Webcam-Based Tachometer for In-Situ Rotational Speed Measurement," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 917-924.  
doi: 10.1109/ICIT45562.2020.9067295  
Abstract: Rotational speed measurement of industrial rotating machinery and mechanical parts is of great interest for process and system monitoring and control, process characterization and fault diagnosis. The estimation of motor load and pulley-belt transmission slip in induction motor driven systems are examples where the rotational speed measurement can be useful. In conventional systems, mechanical coupling of devices such as encoders and resolvers with the rotating shaft/part is required for continuous speed measurement. For short-time measurements, optical reflection or stroboscopic techniques can be used through noninvasive contactless optical tachometers. Reflective marks or strips in the rotating parts are usually required when using optical tachometers. In this paper, the results of several experimental tests under different light sources for an innovative nonintrusive, low-cost, webcam-based tachometer, previously proposed by the authors, are presented and discussed. For a motor shaft speed varying between 750 and 3000 rpm, the average error obtained with the proposed solution was lower than 0.2%. Such solution can be used to continuously measure the speed of a given rotating part during an in-situ energy audit or operation characterization period, with real-time data logging and without sticking reflective strips or introducing shaft-coupled encoders/resolvers, allowing the speed to be easily estimated/measured and recorded over time in, for example, electrical motors, pulleys, shafts and wind turbines.  
keywords: {Velocity control;Rotation measurement;Tachometers;Induction motors;Cameras;Velocity measurement;Sensors;energy audits;in-situ measurement;noninvasive rotational speed measurement;motor rotational speed;tachometer;video camera;webcam},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067295&isnumber=9067096>  
  
F. J. T. E. Ferreira, J. Alberto and A. T. de Almeida, "Voltage Unbalance Impact on Coil-Side Temperature Rise in a Delta-Connected, Dual-Winding Induction Motor," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 925-930.  
doi: 10.1109/ICIT45562.2020.9067201  
Abstract: The performance of three-phase induction motors is negatively affected when the supply voltages are unbalanced, which is a common situation in industrial facilities. The resulting unbalance of the motor phase currents leads to an increase of the motor vibration, slip, rotor losses, maximum phase current, and maximum temperature rise in the windings. In this paper, the phase current unbalance and the coil-side temperature rise in each stator slot of an induction motor with a reconfigurable delta-connected dual winding and unbalanced supply voltages, is investigated. This investigation is done for three different spatial displacement angles between the two partial windings, namely, 0, 20 and 40 electrical degrees, and is based on experimental results and on the distribution of the coil sides in the stator slots. The current-based motor derating curves as a function of voltage unbalance ratio for the three different spatial displacement angles are also presented. It was found that, for the tested 36-slot, delta-connected, dual-winding induction motor and the considered supply voltage unbalance, a spatial displacement angle between the two partial windings of 40 electrical degrees can reduce the maximum value of the per-unit per-slot average coil-side temperature rise and the phase current unbalance ratio.  
keywords: {Windings;Induction motors;Stator windings;Hysteresis motors;Voltage measurement;Estimation;delta connection;dual winding;induction motor;partial windings;phase current unbalance;spatial displacement angle;stator windings;supply voltage unbalance;winding temperature},  
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"EESEV Energy Exchange Systems for Electric Vehicles," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 931-932.  
doi: 10.1109/ICIT45562.2020.9067309  
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J. D. Valladolid, R. Albarado, D. Mallahuari and D. Patiño, "Experimental Performance Evaluation of Electric Vehicles (EV) Based on Analysis of Power and Torque Losses," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 933-938.  
doi: 10.1109/ICIT45562.2020.9067241  
Abstract: Nowadays, due to different pollution factors, the electric vehicle is considered as a solution for the energy and environmental crisis, but it has not yet managed to outperform internal combustion vehicles due to limited energy density, therefore, it is necessary to study in which parts of the electric vehicle the greatest losses of powers occur to find the most optimal points of operation of the EV, which opens up possibilities to raise energy optimization issues and thus try to obtain greater efficiency and autonomy, this paper presents a methodology for the analysis of energy efficiency in electric vehicles (EV). To obtain a measurement of the real power in the wheels, a MAHA LPS 3000 dynamometer bank was used. In addition, a data acquisition system (DAS) that records different variables necessary for the analysis obtained directly from the ECU through the on-board diagnostic port (OBD), according to the analysis performed, it is concluded that the power losses are not a function of the value of the state of charge (SOC), the results of the calculated losses and the analysis in measurements are detailed in power curves for different systems (electric motor, inverter and mechanical transmission). Finally, efficiency curves are presented, showing the optimum operating points of each component analysed.  
keywords: {Propagation losses;Torque;Wheels;Loss measurement;Inverters;Mathematical model;Dynamometers;Electric vehicle;power losses;torque losses;inverter;dynamometer bank;efficiency},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067241&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067121  
Abstract: This paper presents details of powertrain system modelling of an electric vehicle (EV), which is based on the permanent magnet synchronous motor (PMSM) mathematical models, the transmission and the longitudinal dynamic of the EV. The traction system parameters were estimated using the Nonlinear Minimum Square (NLS), algorithm and experimental data. Experiments and simulations were performed to verify the accuracy of the results and the effectiveness of the models. The system has been modeled and simulated by using the Matlab and Simulink platform.  
keywords: {Mathematical model;Torque;Data models;Electric vehicles;Permanent magnet motors;Mechanical power transmission;Vehicle dynamics;Mathematical model;Parameter estimation;Optimization algorithm;Permanent Magnet Synchronous Motor;Electric Vehicle},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067121&isnumber=9067096>  
  
"EESSTE Electric Energy Storage Systems for Transportation Electrification," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 945-946.  
doi: 10.1109/ICIT45562.2020.9067308  
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Abstract: This paper presents a constant temperature and constant voltage (CT-CV) based charging technique applied to a Nickel Manganese Cobalt (NMC) 18650 and lithium-ion cells. Analysis and behavior of the cell at different ambient temperature have been investigated in this paper. Moreover, the experimental procedure details, including the implemented CT-CV algorithm for analyzing the charging of batteries are detailed. The proposed CT-CV charging is compared with existing constant current and constant current (CC-CV) under different ambient temperatures and charging current rates. Finally, experimental validations are performed on NCM batteries and the results are presented.  
keywords: {Batteries;Temperature measurement;Battery charge measurement;Voltage measurement;Discharges (electric);Temperature distribution;Temperature sensors;Battery chargers;constant temperature charging;CT-CV charging;fast charging;lithium-ion batteries},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067186&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067246  
Abstract: State-of-Charge (SOC) balancing control is one of the issues to be settled in energy storage system (ESS). In this paper, a distributed SOC balancing control strategy is proposed for the super capacitor energy storage system based on modular multilevel DC/DC converter. Independent voltage and current loops are constructed for each sub-module. In order to achieve SOC balancing control, the SOC of each super capacitor module (SCM) is introduced into the current loop, so that the sub-modules can regulate their average operating current according to their own SOC. Thus, the SOC of SCMs can be balanced during system dynamic charging and discharging process. The operating principle of the proposed method is similar with the droop method used in parallel system, therefore this strategy can keep each sub-module independent of each other during operation modes and enhance the modularity of the system. Besides, the structure of the strategy does not change with the increase of the number of series modules, so it is conducive to the extended application of the modular energy storage system. The basic principle and operating characteristics of the proposed strategy are analyzed. Finally, the proposed strategy is validated effectively by experiment results.  
keywords: {Discharges (electric);Capacitors;Energy storage;Voltage control;Control systems;Inductance;Transfer functions;SOC balancing control;modular multilevel DC/DC converter;energy storage system;distributed balancing control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067246&isnumber=9067096>  
  
R. Hidalgo-León, J. Urquizo, J. Litardo, Y. Muñoz-Jadán, P. Singh and J. Wu, "Simulation of battery discharge emulator using power electronics device with cascaded P-I control," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 959-964.  
doi: 10.1109/ICIT45562.2020.9067170  
Abstract: This paper proposes a battery discharge emulator to simulate the discharge behavior of a commercial Li-ion battery. The emulator is based on a power electronics circuit that allows the ripple levels of its voltage output to be reduced. A system based on three-phase interleaved DC-DC boost converter in combination with an electric equivalent circuit battery model enables to emulate the discharge behavior of the battery. The parameters for the electrical equivalent circuit model were extracted using the time-domain parameter extracted method. The voltage response characteristics for the emulator were validated experimentally under the same discharge profiles as the Li-ion battery. The results of the simulations show maximum absolute errors of around 3% in replicating the steady state and dynamic behavior for the output voltage of the Li-ion battery with discharge currents up to 1C rate (4A).  
keywords: {Discharges (electric);Mathematical model;Lithium-ion batteries;Inductors;State of charge;Voltage control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067170&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067117  
Abstract: When it comes to smart manufacturing, flexibility is an essential feature as it leads to on demand fabrication of various types of products in a factory with less down time and high throughput. This paper addresses dynamic communication infrastructure needed to provide the above mentioned flexibility. We consider a heterogeneous communication system, consisting of wired and wireless networks, that is managed by software defined networking and propose an admission control residing in the SDN controller and dynamically managing the bandwidth allocation among wireless nodes. To evaluate the proposed protocol we implement the admission control scheme in real hardware and perform a set of experiments to show the applicability and overhead of the protocol.  
keywords: {Bandwidth;Admission control;Wireless sensor networks;Switches;Wireless networks},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067117&isnumber=9067096>  
  
P. Filipovikj, A. Čaušević and E. Lisova, "Service Realizability Check as a Technique to Support a Service Security Assurance Case," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 973-980.  
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Abstract: Advances in cloud computing make cloud services as an appealing solution for enabling services flexibility and availability on demand to accommodate users' needs. The terms and the guarantees of service provision are negotiated and then stated in a Service Level Agreement (SLA). To facilitate a wider acceptance of such services, beside the standard properties, security has to be taken into consideration as well. One way to facilitate this is to provide a corresponding security assurance case. For that purpose, in this work we propose to split the security service assessment between an independent third party and a service user, where the former assess a security assurance case and the latter negotiates particular security solutions implemented for a service. For the systematic part of the security process that is independently assessed, in this paper we focus on the formal realizability check of service constraints expressed within an SLA. To enable this, we formalize the check at both service design-, and run-time, needed due to frequent updates required to maintain an agreed security level. The formalization is tailored for the SLAC language specifically, which is extended to cover a proposed set of security objectives. Moreover, we use an example of an SLA expressed in terms of SLAC language, which includes security guarantees to illustrate the approach.  
keywords: {Cloud computing;Syntactics;Monitoring;Encryption;Business;Reliability;Service Level Agreements;Service Realiziability Checking;SLAC;Service Security;Assurance Case},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067250&isnumber=9067096>  
  
M. Ventovaara, A. Hasanbegović, J. Wiklandert and S. Mubeen, "Worst-case Execution Time Estimation of Legacy Vehicular Embedded Functions: An Industrial Case Study," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 981-986.  
doi: 10.1109/ICIT45562.2020.9067160  
Abstract: Estimation of Worst Case Execution Times (WCETs) of software functions in a real-time embedded system is fundamentally important in verifying its timing behaviour. Many existing WCET analysis tools and benchmarks, based on static WCET analysis methods, are limited to analyse software functions that conform to specific programming languages and libraries. As a consequence, these tools do not support WCET estimation of software functions in legacy industrial systems that do not conform to those languages and libraries. This paper advocates the use of a statistical method based on extreme value theory for estimating WCETs of software functions in such legacy industrial embedded systems. The main advantage of this method is that it is agnostic of the languages and libraries that are used to implement the software functions. In order to provide a proof of concept, the paper incorporates an industrial use case and applies the method to estimate WCETs of its software functions. The paper also presents an extensive comparative evaluation of the statistical method and an established static analysis tool for estimating WCETs that utilises high-level flow analysis.  
keywords: {Task analysis;Estimation;Software;Tools;Libraries;Probability;Statistical analysis},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067160&isnumber=9067096>  
  
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D. K. Singh, R. A. Haraty, N. C. Debnath and P. Choudhury, "An Analysis of the Dynamic Community Detection Algorithms in Complex Networks," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 989-994.  
doi: 10.1109/ICIT45562.2020.9067224  
Abstract: Uncovering the dynamics of community structures in complex networks helps us to explore how such community structures change over time. But, understanding these structures is very challenging, especifically in dynamic complex networks where network structure changes frequently and interaction between the individuals changes over time. Recently, many dynamic community detection algorithms have been introduced to capture the dynamics of network community structures. In this paper, we present a detailed analysis of the dynamic community detection algorithms in terms of computation time and accuracy. To provide detailed and extensive analysis, we tested dynamic algorithms on small, medium and large real-world network dataset. Based on the analysis results and network properties, we provide some guidelines that may help to choose the best dynamic community detection algorithms for the given dynamic complex networks.  
keywords: {Heuristic algorithms;Detection algorithms;Complex networks;Employment;Machine learning algorithms;Classification algorithms;Computer science;complex networks;dynamic networks;evolving networks;temporal networks;community structure;community detection;dynamic community;dynamic algorithms},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067224&isnumber=9067096>  
  
S. Pal, S. K. Mishra, C. K. Rath, N. C. Debnath and A. Sarkar, "Enrichment of Semantic Sensor Network Ontology: Description Logics based approach," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 995-1000.  
doi: 10.1109/ICIT45562.2020.9067133  
Abstract: Description Logics (DLs) is the formalism of representing knowledge in Web Ontology Language (OWL). The Semantic Sensor Network Incubator Group (SSN-XG) developed the Semantic Sensor Network (SSN) ontology. However, there is less attention paid to develop any rigorous formal approach for it. This paper aims to enhance the semantics of SSN ontology by developing suitable DLs. Various concepts of such ontology are elaborated logically and with the support of suitable case study. The novelty of the proposed research work is to understand and represent the inherent knowledge of SSN ontology using DLs. Thus, it facilitates mathematical proof system.  
keywords: {Ontologies;Semantics;Actuators;OWL;Knowledge based systems;Sensors;Cognition;Description Logics;Semantic Sensor Network Ontology;Sensor;Sampler;Actuator;Knowledge base},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067133&isnumber=9067096>  
  
B. Boukhari, C. Boueri, R. Islambouli, Z. Sweidan and R. A. Haraty, "SQA Models Comparative Analysis," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1001-1006.  
doi: 10.1109/ICIT45562.2020.9067276  
Abstract: The high competition among various companies in software development enforces strict metrics to measure the quality of software produced and enhance its performance while evaluating the cost carried out to apply those metrics. This comes along with critical demands such as safety, accuracy, availability, scalability and durability. One of the key principles to ensure such metrics is to consider integrating software quality assurance (SQA) models as they add special assessment features into the software development process. In this paper, we present a comprehensive review for the state-of-the-art of various SQA models applied in the realm of software development. In addition, our study encompasses a comparative analysis between the different SQA models. Our work covers SQA Models, SPI, SPA, ISO standards, CMM, CMMI and SPICE.  
keywords: {Software;ISO Standards;Organizations;Standards organizations;Total quality management;SQA Models;SPI;SPA;ISO standards;CMMI;CMM;SPICE},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067276&isnumber=9067096>  
  
O. A. Testa, E. R. Fonseca C., G. Montejano, N. C. Debnath and O. Dieste, "WS-CDL: Coordinating Ubiquitous Devices in Pervasive Environments Using a Web Standard," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1007-1012.  
doi: 10.1109/ICIT45562.2020.9067311  
Abstract: We are permanently interacting with ubiquitous devices in our daily lives, and with services they present. Ubiquitous devices need to cooperate with other devices in order to provide services. There are some cooperation mechanisms for provide services, but they are commonly proprietary. The few proposals from academy have hardly achieved an impact in practice. This it is not in harmony with the situation of the Internet environment and web services, which have standardized mechanisms for the composition of services. To applicate Service Oriented Architecture (SOA) specifications and standards for ubiquitous devices coordination in pervasive environments. We apply an adaptation of Design Science in our environment to allow the iterative construction and evaluation of prototypes. We built and put into operation a coordination framework for ubiquitous devices based on WS-CDL, along with a proof of concept. In addition, we contribute to WS-CDL language in order to support the characteristics of specific ubiquitous devices.  
keywords: {Service-oriented architecture;Software engineering;Ubiquitous computing;Web services;Software Engineering;SOA;Ubiquitous devices;Services;Choreography Services},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067311&isnumber=9067096>  
  
"ISCTCA Impedance Source Converters Topologies, Control and Applications," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1013-1014.  
doi: 10.1109/ICIT45562.2020.9067294  
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M. Aly, N. Mayorga and A. M. Llor, "A Simplified SVPWM Method for Neutral Point Voltage Control and Common Mode Voltage Reduction in Three-Level qZS T-type PV Inverters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1015-1020.  
doi: 10.1109/ICIT45562.2020.9067262  
Abstract: This paper presents a simplified space vector pulse width modulation (SVPWM) method for three-level T-type quasi-Z-source (qZS) photovoltaic (PV) inverters. The proposed SVPWM method achieves multi-functionalities for the qZS T-type PV inverter, such as boosting the PV voltage, controlling the neutral point (NP) voltage, and reducing the common mode voltage (CMV), while preserving simplified implementation. The shoot-through duty cycle is added uniformly during the switching cycles, whereas, the redundant small voltage vectors are employed for controlling the NP voltage. The complex computations and cascaded proportional-integral (PI) control algorithms of the conventional SVPWM methods are eliminated in the proposed SVPWM. Thence, the proposed SVPWM can dramatically reduce the computation burdens. The performance of the new proposed SVPWM algorithm has been demonstrated using comprehensive simulation studies for various operating points, dynamics and imbalance conditions.  
keywords: {photovoltaic (PV);quasi-Z-source (qZS);space vector modulation;Three-level T-type inverter},  
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D. Vinnikov, A. Chub, O. Korkh, E. Liivik and A. Blinov, "Voltage Gain Extension Techniques for High Step-Up Galvanically Isolated DC-DC Converters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1021-1027.  
doi: 10.1109/ICIT45562.2020.9067115  
Abstract: This paper discusses voltage gain extension intended for the galvanically isolated impedance-source DC-DC converters under the principle of combined energy transfer when the energy is transferred from the primary to the secondary side using an isolation transformer and a coupled inductor of the impedance-source network. Different realization approaches of the combined energy transfer are evaluated; the main emphasis is on the power conversion efficiency and realization complexity. Also, the application of topology morphing control to the galvanically isolated impedance-source DC-DC converters with combined energy transfer is analyzed. An experimental prototype rated for 100 W was used to validate all the findings.  
keywords: {Inductors;Energy exchange;Switches;Windings;Capacitors;Magnetic cores;Rectifiers;DC-DC converter;impedance-source converter;single-switch converter;topology morphing control;efficiency},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067115&isnumber=9067096>  
  
"MIMCMD Modelling, Identification, Modulation and Control of Multiphase Drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1028-1030.  
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J. A. Riveros, J. Prieto and M. Rivera, "An Overmodulation Technique for Asymmetrical Six-Phase Voltage Source Inverters With Low Voltage Harmonic Injection," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1031-1036.  
doi: 10.1109/ICIT45562.2020.9067238  
Abstract: This paper introduces a novel overmodulation strategy for two-level six-phase voltage source inverters based on a dual three-phase model. The architecture is an extension of a modulator recently presented in the literature. The algorithm is based on a generalised solution of the duty cycles, and a preprocessor is added to modify the target voltage appropriately to compensate the synthesised voltage. The redesigned architecture can generate voltage beyond the linear region with a low injection of undesired harmonic components in the inverter output. Simulations and experimental tests are carried out to validate the theoretical results. The performance achieved with this proposal is compared respect to a minimal distortion method, and a slightly lower voltage harmonic content is obtained.  
keywords: {Harmonic analysis;Phase modulation;Inverters;Voltage control;Pulse width modulation;Computer architecture;Pulse width modulation;DC-AC power converters;multiphase systems},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067238&isnumber=9067096>  
  
O. González et al., "Comparative Assessment of Model Predictive Current Control Strategies applied to Six-Phase Induction Machines," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1037-1043.  
doi: 10.1109/ICIT45562.2020.9067279  
Abstract: Nowadays, model predictive current control strategy has become a viable alternative because of its fast response for high-reliability systems, such as multiphase machines. In that regard, this paper proposes a comparative assessment of four current controllers based on the model using different approaches as virtual vectors, modulation techniques and further, combining these strategies in order to deal at the same time with the regulation of the main and secondary currents components, known as (α-ß) and (x-y), respectively, applied to six-phase induction machines. Simulation results are presented so as to show the effectiveness of the four model predictive current controllers, taking into account the mean squared error and the total harmonic distortion of the stator currents in both steady and dynamic conditions.  
keywords: {Stators;Mathematical model;Rotors;Current control;Switches;Predictive models;Induction machines;Multiphase machines;predictive current control;six-phase induction machine;virtual vectors},  
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F. Becker and F. Scuiller, "Fault-tolerant control of a 7-Phase Surface-mounted PM Machine with tooth-concentrated winding," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1044-1049.  
doi: 10.1109/ICIT45562.2020.9067177  
Abstract: This paper addresses the implementation of a fault-tolerant control for a seven-phase Surface-mounted PM machine (with tooth-concentrated winding to improve the fault tolerant ability). At any time, for a given torque demand, from off-line estimated electromotive force, an inherently fault-tolerant Maximum Torque Per Ampere control strategy calculates the reference currents taking into account the number of available phases. According to preliminary simulations, building the computed electromotive force with harmonics one, three and five appears as a good compromise between torque ripple reduction and peak current mitigation in safe and open-circuit fault operations. Experimental tests confirm these results.  
keywords: {Torque;Harmonic analysis;Windings;Fault tolerance;Fault tolerant systems;Circuit faults;Magnetomechanical effects;Multi-phase machine;fractional-slot winding;open-circuit fault;fault-tolerant control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067177&isnumber=9067096>  
  
"MPCPCD Model Predictive Control in Power Converters and Drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1050-1052.  
doi: 10.1109/ICIT45562.2020.9067223  
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doi: 10.1109/ICIT45562.2020.9067230  
Abstract: Finite set model predictive control (FS-MPC) has shown the features of a simple and practical method in power electronics application. Increasing the number of the voltage vectors in FS-MPC is useful to reduce the harmonic distortion of currents, and the voltage and the torque ripple. Despite all of the advantages this method has a high computation burden. For the vector increase, due to expenses of multi-level inverters, i.e., hardware solution, the discrete space vector modulation, i.e., software solution, is used in lower power applications. Reducing the number of feasible vectors in the cost function is a challenge. In this paper, a new method is proposed for fast and easy detection of the triangle that the reference voltage vector is located. The method uses the magnitude and the phase angle of the reference voltage. By this method, the process of determining the closest three vectors is eased. The validity of the proposed method is verified by the simulation.  
keywords: {Inverters;Predictive control;Cost function;Voltage control;Mathematical model;Computational modeling;Modulation;virtual vectors;computation reduction;finite set model predictive control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067230&isnumber=9067096>  
  
S. Toledo et al., "Active and Reactive Power Control based on Predictive Voltage Control in a Six-Phase Generation System using Modular Matrix Converters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1059-1065.  
doi: 10.1109/ICIT45562.2020.9067285  
Abstract: Renewable energy generation systems under distributed generation frame emerges as a plausible solution for nowadays growing world energy demands. In this context multiphase wind generation systems are a feasible option that consist of renewable AC source that need efficient and totally controlled power conversion stages. In this work a novel active and reactive power control strategy based on two cascade control loops using a combination of classical PR controller and Model Based Predictive Voltage Control is proposed. Furthermore, the generator is a Permanent Magnet Synchronous Generator and the power stage is based on a multi-modular direct matrix converter topology providing interesting features to the scheme. The performance of the whole system is analysed regarding tracking of reference and THD with satisfying transient results and THD lower than 1.52 % in the injected current widely accomplishing with international standards.  
keywords: {Topology;Voltage control;Matrix converters;Stator windings;Monte Carlo methods;Generators;Windings;Distributed Generation System;Multi-modular Matrix Converter;Multi-phase Machines;Predictive Control;Predictive Voltage Control},  
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A. Renault, M. Ayala, J. Pacher, L. Comparatore, R. Gregor and S. Toledo, "Current control based on space vector modulation applied to three-phase H-Bridge STATCOM," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1066-1070.  
doi: 10.1109/ICIT45562.2020.9067211  
Abstract: This paper presents a modulated model predictive current control (MPC) based on space vector analysis applied to a three-phase H-Bridge STATCOM. This article proposes a modulation strategy, based on space vector modulation in α- β subspace, in order to mitigate the propagation of the THD of the current injected in the point of common coupling (PCC). Simulation results based are provided to quantify the performance, in terms of power RMS ripple and mean square error (MSE) of the measured phase currents and their corresponding references, of the proposed modulated predictive current control.  
keywords: {Automatic voltage control;Reactive power;Integrated circuits;Cost function;Switching frequency;Mathematical model;Modulation;Active power filters;H-bridge converter;predictive current control;space vector modulation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067211&isnumber=9067096>  
  
L. Tarisciotti, C. Burgos, C. Garcia and J. Rodriguez, "Finite Control Set Model Predictive Control of parallel three-phase active rectifiers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1071-1076.  
doi: 10.1109/ICIT45562.2020.9067141  
Abstract: In recent years, Model Predictive Control (MPC) has been successfully applied to the control of power electronics converters with different topologies and for different applications. MPC offers many advantages over more traditional control techniques such as the ability to avoid cascaded control loops, easy inclusion of constraint and fast transient response. Finite Control Set Model Predictive Control considers the discrete nature of power electronics converters to simplify the control derivation and implementation. In order to show the capabilities of Finite Control Set Model Predictive Control, this paper proposes an application of such technique to parallel three-phase boost rectifiers control, where AC active and reactive power, DC voltage and zero Sequence power are controlled within one single control loop. The proposed control approach is validated through simulation, and results are provided in several operating conditions.  
keywords: {Rectifiers;Mathematical model;Control systems;Reactive power;Predictive control;Power electronics;Cost function;Predictive Control;Power Electronics;Three Phase Active Rectifier},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067141&isnumber=9067096>  
  
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Abstract: In this paper, a model predictive control (MPC) of a synchronous reluctance motor (SynRM) with a fault tolerance against an open-phase fault is proposed. The MPC algorithm is based on the finite control set strategy and takes into account the modified inverter topology which was used to make the fault tolerance possible. The algorithm is intuitive and easy to implement. It provides a fast torque response and smooth transition into fault operation without any torque drop.  
keywords: {Torque;Inverters;Switches;Topology;Voltage control;Circuit faults;Prediction algorithms;Fault Tolerance;FCS-MPC;SynRM},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067220&isnumber=9067096>  
  
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Abstract: The model predictive control (MPC) strategy has been extensively investigated for the control of modular multilevel converters (MMCs). To avoid the high amount of calculation for the evaluation of all switching states, the MPC can be used to determine only the arm voltage level while the submodule (SM) gate signals are further determined by capacitor voltage sorting scheme. Among such techniques, there are some methods based on the evaluation of adjacent voltage levels, the effectiveness of which diminishes as the number of SMs of MMC increases. To overcome this drawback, this paper proposes a solution based on SM-grouping technique considering the current-regulating capacity. Several simulation tests are carried out on an MMC-based high power system with 128 SMs per arm, the results of which validate the enhancement of performance (steady-state and dynamic) of the MPC method resulted from the proposed approach.  
keywords: {Capacitors;Voltage control;Current control;Computational efficiency;Switches;Steady-state;Resistance},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067174&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067297  
Abstract: This paper presents a model-free predictive current controller (MFPCC) based on ultra-local model for three-phase voltage source PWM rectifier (VSR), which has an inherent rapid dynamic response as a result of the MPC controller, as well as robust control performance due to use of the ultra-local model. The proposed approach, which utilizes model-free predictive current controllers, does not require any plant identification while ensuring the stability and the robustness of the control synthesis. Simulation and experimental results on a 3-phase/150V VSR indicate that, with a simple control structure, insensitivity to power supply fluctuations and to large load variations is ensured.  
keywords: {Mathematical model;Predictive models;Robustness;Pulse width modulation;Load modeling;Steady-state;Current control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067297&isnumber=9067096>  
  
L. Tarisciotti, C. Linglin, P. Wheeler and P. Zanchetta, "Moving Discretised Control Set - Model Predictive Control for Dual-Active-Bridge," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1094-1099.  
doi: 10.1109/ICIT45562.2020.9067129  
Abstract: In many DC/DC converters applications, classical proportional-integral control is often considered. However, when complex converters structures, such as Dual Active Bridge converters, are considered, several challenges may be faced in the control design. In fact, achieving an accurate Dual Active Bridge model may be complex, considering that the small signal model of the circuit varies according with its operating mode. Moreover, Dual Active Bridge converters usually requires a robust control design, due to their high input/output voltage ratio and power level. In order to address these issues, a Moving Discretized Control Set - Model Predictive Control is introduced. The proposed control can achieve faster dynamics and stable operation throughout the power and terminal voltage ranges, considering global control parameters. It also presents a fixed switching frequency with low computational burden, due to the use of only two prediction horizons. Experiments on a 20kHz 1kW Dual-Active-Bridge converter are carried out to verify the effectiveness of the proposed control technique.  
keywords: {Voltage control;Modulation;Optimization;Predictive control;Bridge circuits;Integrated circuit modeling;Switching frequency;Predictive Control;Power Electronics;Dual Active Bridge},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067129&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067169  
Abstract: Model-based predictive control (MPC) is an attractive solution for controlling power converters and drives. This research shows the most recent alternatives of predictive control techniques proposed in the literature to solve control problems in power converters. The current trends and future projections for these control strategies, as well as the most used models, topologies, or variables in different scenarios are shown. This allowed us to compare the main strategies, their pros and cons, including some application examples. Predictive control has several advantages that make it suitable for the control of power converters and drives.  
keywords: {Predictive control;Cost function;Modulation;Predictive models;Computational modeling;Switches;Inverters;power converters;model predictive control;power electronics},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067169&isnumber=9067096>  
  
S. R. Eftekhari, S. A. Davari, P. Naderi, C. Garcia and J. Rodriguez, "Reducing the Parameter Dependency of Model-Based Loss Minimization Method for Induction Motor Drives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1106-1111.  
doi: 10.1109/ICIT45562.2020.9067291  
Abstract: Efficiency Improvement is an essential objective of today's industrial world. Among the many techniques for loss minimization methods (LMM), a loss-model controller (LMC) has some advantages: high accuracy and fast response. However, the accuracy of LMM is very depended on the precision of the parameters. On the other hand, among different models of the loss, the parameters of the flux-based model are more uncertain because they need accurate magnetic analysis. This model is used for model predictive torque and flux control (MPC) more prevalently. In this research, in order to solve this drawback, a new flux optimization approach is presented for MPC. This matter has been fulfilled by dividing the consubstantial parameters. Besides, the need for the eddy current and hysteresis coefficients calculations have been removed by substitution of iron core loss resistance. By this approach, in a way, the estimation accuracy of iron core loss will increase. Simulations and experiments have used for performance verifying of the proposed method. For more accuracy, the parameters of the simulated motor are identified by analyzing an induction motor (IM) in ANSYS Maxwell.  
keywords: {Rotors;Stator windings;Induction motors;Stator cores;Iron;Hysteresis motors;Efficiency optimization;induction motor;loss minimization;real-time;predictive torque control;implementation},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067291&isnumber=9067096>  
  
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doi: 10.1109/ICIT45562.2020.9067317  
Abstract: This paper presents a variable switching point parallel predictive torque control (VSP3TC) strategy for an induction motor. VSP3TC is introduced as one method of the Finite-Set Model Predictive Control (FS-MPC) methodology. The mainly three drawbacks of FS-PMC are high ripples on controlled variables, adjustment of weighting factors and high calculation effort demand, respectively. VSP3TC implements a recently proposed parallel predictive torque control (PPTC) algorithm by means of a variable switching point. In this way, not only can a switching state be applied for less than a whole sample cycle which results in a lower torque ripple, but weighting factor can also be eliminated. Experimental results are provided to verify the performance of VSP3TC strategy.  
keywords: {Switches;Torque;Stators;Torque control;Induction motors;Electromagnetics},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067317&isnumber=9067096>

"MPETSREMASI Modern Power Electronics Trends and Solution for Renewable Energy and Microgrid Applications Smart Innovatives," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1118-1120.  
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doi: 10.1109/ICIT45562.2020.9067130  
Abstract: Progress requires greater global energy interconnection. This paper presents an overview of the topologies and control techniques applied to microgrids, by means of an updated bibliographic research and the most relevant articles on the use of power electronics in microgrids interconnection. The topologies and control techniques investigated in this paper expose a reality that leads to commercial solutions applied to microgrids, giving new tools to the energy market.  
keywords: {Microgrids;Topology;Inverters;Buck converters;Frequency conversion;Microgrids;Interconnection;Topologies;Power Converters;Control;HVDC},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067130&isnumber=9067096>  
  
P. Silva, J. Muñoz, R. Aliaga, A. Villalón, D. Rojas and D. Murillo-Yarce, "Control of a DC/DC Converter attached to an Asymmetric Multilevel Inverter for Solar Energy Injection to Microgrids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1127-1132.  
doi: 10.1109/ICIT45562.2020.9067163  
Abstract: This paper is based mainly on selecting a DC-DC converter that allows the proper operation of the cascaded 27-level asymmetric multilevel inverter that injects photovoltaic energy into a microgrid. The work consists mainly on designing, building and controlling the DC/DC converter appropriate for this topology. The topology of the asymmetric multilevel converter requires independent and in the 9:3:1 ratio DC voltages, adding to this the control for the extraction of the maximum power of the photovoltaic panels. Only the low power cell is addressed in this paper and a string photovoltaic configuration is used. The system is validated using simulations and incorporating experimental results for the buck converter in cascade with the non-inverting buck boost converter with resistive load and a battery as extracted energy storage from a photovoltaic string.  
keywords: {Voltage control;Switches;Maximum power point trackers;Topology;Legged locomotion;Inverters;Microgrids;DC/DC;Maximum Power Point Tracking;Photovoltaics;Buck-Boost;H-Bridge;Asymmetric Multilevel Converter},  
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W. C. Leal et al., "Management and Control of a Bidirectional Electric Station in DC Microgrids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1133-1138.  
doi: 10.1109/ICIT45562.2020.9067191  
Abstract: This paper presents a SoC-sharing function for a management of bidirectional electric station in the microgrids context. The algorithm proposed in this paper is able to execute fast or slow charges and discharges to the Electrical Vehicle (EV) battery according to the State of Charge (SoC) availability. Thus, through a Cascaded Interleaved Buck-Boost Converter, this management will also regulate the DC link voltage. A study of the model, control structure and management technique is presented. Finally, a series of stand-alone simulations validate this technique by using the PSIM® software package.  
keywords: {Batteries;Voltage control;Integrated circuit modeling;Discharges (electric);Capacitors;Microgrids;Electric vehicles;voltage balance;bidirectional electric station;vehicle-to-grid technology;Smart Grids},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067191&isnumber=9067096>  
  
A. Villalón, C. Muñoz, R. Aliaga, J. Muñoz, M. Rivera and P. Zanchetta, "Power Sharing Control of Islanded AC Microgrid Considering Droop Control and Virtual Impedance," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1139-1144.  
doi: 10.1109/ICIT45562.2020.9067231  
Abstract: Microgrids appear as the key part of the future power systems that include distributed generators, renewable energy, and energy storage. In this paper a decentralized power sharing control scheme that includes droop control with virtual impedances with PI controllers for the voltage and current is proposed for an islanded AC microgrid with two voltage source inverters in parallel that share a residential load. To avoid circulating currents and unbalanced power sharing due to line impedance differences in the microgrid, virtual impedances are added. The proposed control scheme is implemented in MAT-LAB/Simulink to prove the proper operation under inductive behavior and mismatches in the line impedances of the microgrid system.  
keywords: {Microgrids;Impedance;Voltage control;Inverters;Frequency control;Reactive power;Inductors;Microgrid;Power Sharing;Droop Control;Virtual Impedance;Reactive Power Sharing;PI control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067231&isnumber=9067096>  
  
A. L. Kouzou, A. Krama, S. S. Refaat and H. Abu-Rub, "Selective Harmonic Elimination PWM For a Cascaded Multi-level Inverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1145-1150.  
doi: 10.1109/ICIT45562.2020.9067207  
Abstract: This paper deals with the selective harmonic elimination pulse width modulation (SHE-PWM) technique. This technique is used for the elimination of selected dominant low order harmonics in the multi-level inverter output voltage. The presence of these harmonics is the essential drawback of such kind of inverters; especially when it is used for the control of different AC drivers. The SHE-PWM is based on the minimization of a constrained nonlinear objective function whose variables are the switching angles used for multi-level inverter control. The solution of this optimization problem can be achieved using different metaheuristic optimization algorithms. An approach of SHE-PWM based on Particle Swarm Optimization (PSO) algorithm is proposed in this paper. Different patterns of optimal switching angles shown in a previous work, which are based on groebner bases and symmetric polynomials theory (GBSP), are improved in this paper using PSO. The improved earlier patterns are compared with the proposed approach. The obtained experimental and simulation results are aimed to verify the efficiency and the capability of the proposed approach in improving the Total Harmonic Distortion (THD) while eliminating the desired low frequency harmonics.  
keywords: {Harmonic analysis;Switches;Inverters;Linear programming;Pulse width modulation;Optimization;SHE-PWM;meta-heuristic;PSO;multi-level inverter},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067207&isnumber=9067096>  
  
N. Bandara, K. Gunawardane and N. Kularatna, "Supercapacitor based RC loop loss circumvention technique to improve the efficiency of photovoltaic inverters," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1151-1156.  
doi: 10.1109/ICIT45562.2020.9067272  
Abstract: When charging an uncharged capacitor to its maximum voltage V by the pumps Q amount of coulombs, irrespective of the value of the total loop resistance, 1/2QV is dissipated through the loop resistance. If we add a useful load as a part of the RC charging loop's resistance, a significant amount of dissipated energy can be recovered via a useful load, increasing the charging efficiency in the loop. Supercapacitor Assisted Sub Module Inverter (SCASMI) concept is proposed based on the fundamentals of the aforementioned RC loop loss circumvention technique. In this case, a partially precharged Supercapacitor is placed in the RC charging loop with a PV inverter to recover the power wastage. In the SCASMI design, the original specification of the inverter is divided into two identical sub inverter stages with supercapacitor energy circulation front end in a way to minimize the conduction losses by reducing the current through each inverter stage. This paper provides a conceptual background SCASMI concept, implementation details, and experimental results of 24V-240 V prototype SCASMI inverters.  
keywords: {Inverters;Supercapacitors;Resistance;Switches;MOSFET;Prototypes;Supercapacitor;Inverter;PLECS;MATLAB},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067272&isnumber=9067096>  
  
"REE Robotics for Extreme Environments," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1157-1158.  
doi: 10.1109/ICIT45562.2020.9067173  
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E. M. Robador, L. Acha, S. Pedre and A. T. Q. Mamani, "Mechanical Design of an Underwater Robot to Inspect Closed Environments," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1159-1164.  
doi: 10.1109/ICIT45562.2020.9067102  
Abstract: In this work, the design of a robotic inspection module for underwater environments is presented. The leading motivation is the visual inspection of the inside of water containers in nuclear power plants, such as the reactor's vessel. Usually, this task is done manually with an endoscope, which presents drawbacks such as the exposure of operators to radiation. Hence, as an alternative, the use of such a module is proposed. The main requirements for this robot are neutral buoyancy, compact size, smooth shape, and high precision, stability, and maneuverability at low speeds. This paper focuses on the development of the actuators system, which is responsible for the robot's movements. The design is divided in two sub-systems: the propulsion system, for displacements in the space at low speeds, and the buoyancy engine, for vertical translation. Finally, the robot instrumentation and the experimental tests carried out with the manufactured prototype are also discussed.  
keywords: {Robots;Propulsion;Buoyancy;Prototypes;Electronic ballasts;Pistons;Inspection;Spherical Underwater Robot;Nuclear applications;Jets Propulsion;Variable Ballast;Mechanical Design},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067102&isnumber=9067096>  
  
"RMACIMG RESIDENTIAL MICROGRIDS Architectures, Control and Interconnection with Main Grid," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1165-1166.  
doi: 10.1109/ICIT45562.2020.9067284  
Abstract: Start of the above-titled section of the conference proceedings record.  
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R. E. Pérez-Guzmán, Y. Salgueiro, M. Rivera and P. W. Wheeler, "Control Strategy and Communication Architecture for Power Sharing in Microgrids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1167-1172.  
doi: 10.1109/ICIT45562.2020.9067288  
Abstract: The increasing needs of control, security and generation capacity of microgrids, has raised the complexity of the network and have allowed the evolution of architecture as a cluster. This increase in complexity demands control strategies in real-time, to ensure the proper functioning of the electrical system. In this research, a new communication strategy based on OFDM technology is proposed for power sharing in a microgrid cluster. To this, two modulation technologies are used based on OFDM (QPSK and 64-QAM) and the results are compared. The communication channel has been designed according to the properties of dispersion, attenuation, and noise, which are found in the applied environment. The study is based on a simulation model implemented in MATLAB, where was possible to verify the correct performance of the converters when the communications system sends the reference, achieving an error below 1%.  
keywords: {Microgrids;Communication systems;OFDM;Reliability;Mathematical model;Power system reliability;Predictive models;Communicatios;64 QAM;microgrid cluster;OFDM;power sharing;power converters;QPSK},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067288&isnumber=9067096>  
  
A. Blinov, O. Korkh, A. Chub and D. Vinnikov, "Improved Modulation Method for Full-Bridge AC-DC HF-Link Converter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1173-1177.  
doi: 10.1109/ICIT45562.2020.9067128  
Abstract: This paper presents a new modulation method for the cycloconverter stage of the high frequency (HF) link AC-DC rectifier. The method takes advantage of the parasitic parameters of the circuit to provide zero current switching (ZCS) for the AC-and zero voltage switching (ZVS) of the DC-side transistors. Regulation with the power factor correction (PFC) is ensured using only one control variable and no external auxiliary or snubber circuits are required. Moreover, 1/4 of the AC-side transistors are operating with fundamental frequency. The proposed modulation strategy and its design constraints are analysed mathematically and verified with the simulation model of 1 kW, 230 VAC/48 VDC HF-link converter.  
keywords: {Transistors;Modulation;Zero current switching;Zero voltage switching;Inductance;Snubbers;Switches;Cycloconverter;AC-DC rectifier;single stage converter;ZCS;ZVS},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067128&isnumber=9067096>  
  
M. Pham, R. Razi, A. Hably, S. Bacha, Q. Tran and H. Iman-Eini, "Power management in multi-microgrid system based on energy routers," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1178-1183.  
doi: 10.1109/ICIT45562.2020.9067200  
Abstract: This paper proposes a peer-to-peer interaction between microgrids based on energy router to handle network congestions and other local microgrid issues in multi-microgrid system. First, an overview of energy routers in the vision of Energy Internet is addressed. Energy routers with Back-to-Back converter technology is considered in this paper due to its appropriate requirement. Next, a master/slave approach for load sharing and synchronization with energy router in multi-microgrid system is investigated. Finally, a strategy for frequency coordination between microgrids is presented. In fact, in case of frequency violation, microgrids in islanded multi-microgrid system can be supported by other microgrids through an energy router interface. A simulation model is built in MATLAB/Simulink environment to evaluate the efficiency of the proposed method.  
keywords: {Erbium;Voltage control;Microgrids;Frequency control;Smart grids;Power electronics;Topology;back-to-back converter;energy router;frequency coordination;multi-microgrid;voltage source converter},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067200&isnumber=9067096>  
  
A. Bastias, H. Young and B. Pavez, "Virtual Resistance Power Sharing Scheme Based on Sliding Mode Control in Islanded Microgrids," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1184-1189.  
doi: 10.1109/ICIT45562.2020.9067193  
Abstract: Droop control is widely employed for power sharing in islanded microgrids. However, the power sharing accuracy is compromised when feeder parameters between distributed generation units are mismatched. This paper proposes an adaptive virtual resistance scheme implemented using a robust sliding-mode controller (SMC). The modeling uncertainties of the microgrid model are analyzed and a design procedure of the SMC is presented. Local voltage controllers are implemented using finite-set predictive control in order to provide high closed-loop bandwidth and thus decouple voltage and power control loops. Simulation results are discussed to evaluate the effectiveness of the proposed method.  
keywords: {Voltage control;Microgrids;Resistance;Impedance;Reactive power;Inverters;Frequency control;Microgrids;Distributed power generation;Sliding mode control;Predictive control},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067193&isnumber=9067096>  
  
"TDSOC Technology Development and Society Opportunities and Conflicts," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1190-1192.  
doi: 10.1109/ICIT45562.2020.9067167  
Abstract: Start of the above-titled section of the conference proceedings record.  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067167&isnumber=9067096>  
  
A. Lutenberg, "An Approach to the Future of Work: Academia and Industry Alliance to Integrate Work and Study," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1193-1198.  
doi: 10.1109/ICIT45562.2020.9067251  
Abstract: The highly specialized R&D workers of today need to train for years before entering the job market. Once trained it nevertheless takes them a long time to find a suitable position. At the same time Small and Medium Enterprises (SMEs) are reluctant to invest in R&D because of the uncertainty involved. The case study analyzed in this article represents an experience that addresses both issues at once by generating bonds between the University of Buenos Aires “Master's degree on Embedded Systems” program and SMEs. As part of this initiative, SMEs present product proposals to be developed by students along the Master program, as they get the appropriate skills. Students select proposals and carry them out as their final project, while interacting with the company. The methodology proved to be beneficial for both SMEs and students. Context and motivation are presented, along with implementation details, obtained result analysis and a discussion on how to further extend this kind of collaboration.  
keywords: {Companies;Industries;Embedded systems;Collaboration;Consumer electronics;Investment;Proposals;Future of Work;Learning by Doing;SMEs},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067251&isnumber=9067096>  
  
T. Given-Wilson, E. Baranov and A. Legay, "Building User Trust of Critical Digital Technologies," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1199-1204.  
doi: 10.1109/ICIT45562.2020.9067154  
Abstract: Digital technology is permeating all aspects of human society and life. This leads to humans becoming highly dependent on digital devices, including upon digital: assistance, intelligence, and decisions. A major concern of this digital dependence is the lack of human oversight or intervention in many of the ways humans use this technology. This dependence and reliance on digital technology raises concerns in how humans trust such systems, and how to ensure digital technology behaves appropriately. This works considers recent developments and projects that combine digital technology and artificial intelligence with human society. The focus is on critical scenarios where failure of digital technology can lead to significant harm or even death. We explore how to build trust for users of digital technology in such scenarios and considering many different challenges for digital technology. The approaches applied and proposed here address user trust along many dimensions and aim to build collaborative and empowering use of digital technologies in critical aspects of human society.  
keywords: {Medical diagnostic imaging;Medical services;Navigation;Data analysis;Sensors;Digital systems;Databases},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067154&isnumber=9067096>  
  
B. Bulmash and M. Winokur, "Entrepreneurial passion and turnover intentions: The role of intrapreneurship opportunities and risk tolerance," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1205-1209.  
doi: 10.1109/ICIT45562.2020.9067259  
Abstract: In contrast to work examining either employees' workplace exit intentions or entrepreneurial entry intentions, this study considers intention to leave the organization in the context of entrepreneurial passion. The current study focuses on the relationship between passion for inventing products or services as well as for founding a firm and intention to leave the current organization, while considering both employees' risk tolerance and perceived organizational intrapreneurship opportunities. A sample of 229 full-time employees demonstrated that entrepreneurial passion was linked with intention to leave the workplace, as a function of both risk tolerance and perceived organizational intrapreneurship opportunities. Moreover, perceived organizational intrapreneurship opportunities was negatively related to intention to leave the organization, regardless of entrepreneurial passion. We explain these results within the framework of person-job fit.  
keywords: {future of work;entrepreneurial passion;turnover intentions;intrapreneurship opportunities;technological trends impact on societal organization;risk tolerance},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067259&isnumber=9067096>  
  
D. Blank and M. Winokur, "The Digital Era Techno-Economic Paradigm," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1210-1214.  
doi: 10.1109/ICIT45562.2020.9067184  
Abstract: The paper presents a study of characteristics and relationships between technology, economics and semiotics that make up the techno-economic paradigm of the Fifth Industrial Revolution. The objective is to analyze activity parameters of worldwide representative companies in order to advance an understanding of the possibilities and limitations of the digital era economy and its implications in daily life. In particular we explore the relationships between the economics of technology and the symbolic discourse of the emerging trends of the digital era around which both the economy and society as a whole are organized. We conclude with a proposal to establish an initiative to broaden the analysis presented in the paper into an international research of the feasibility and future implications of the emerging paradigm we observe.  
keywords: {Companies;Economics;Industries;Automobiles;Production;Market research;Automotive engineering;techno-economic paradigm;labor;assets;profitability;language},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067184&isnumber=9067096>  
  
"WPT Wireless Power Transfer," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1215-1216.  
doi: 10.1109/ICIT45562.2020.9067165  
Abstract: Start of the above-titled section of the conference proceedings record.  
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doi: 10.1109/ICIT45562.2020.9067136  
Abstract: Wireless power transfer through capacitive coupling interface is being investigated widely as a dual of inductive coupling interface for low to medium air-gap (~1 mm - 100 mm) applications. The value of coupling capacitance is generally dependent on the dielectric material used, area of the plates in the interface and distance between the plates. The paper evaluates the influence of dielectrics on capacitive coupler interface for various air-gaps. The coupling interface can be arranged in different configurations to achieve sufficient power transfer and is validated through the electric field analysis in JMAG.  
keywords: {Capacitance;Couplers;Dielectrics;Couplings;Electric fields;Air gaps;Atmospheric modeling;battery chargers;coupling circuits;dielectrics;electric field;capacitive charging;resonant;reactive power;wireless power transmission},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067136&isnumber=9067096>  
  
L. Agusto, J. Muñoz, A. Villalón, R. Aliaga and J. Guzmán, "Wireless Power Transfer System for an Embedded Energy-Storage System in a PV Microinverter," 2020 IEEE International Conference on Industrial Technology (ICIT), Buenos Aires, Argentina, 2020, pp. 1223-1228.  
doi: 10.1109/ICIT45562.2020.9067104  
Abstract: This paper explains the development of a wireless power transfer system, whereby inductive coils and power converters, charge an embedded energy-storage system in a microinverter, using a photovoltaic panel. A detailed analysis of the design, implementation and control of a station for battery charging, using a PV panel of 35[W] is developed. An inductive-coupling link is used, which consists of transmitting electrical power from a power source to a load using a magnetic field. Finally, the results obtained in simulations from PSIM software and the experimental implementation are contrasted, showing a 12[V] battery which emulates the embedded energy-storage system to prove the concept. Then, the battery is charged with a controlled current of 300[mA].  
keywords: {Coils;Batteries;Inductance;Inverters;Buck converters;Wireless power transfer;Photovoltaic systems;Wireless Power Transfer;DC-DC power conversion;Energy Storage},  
URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9067104&isnumber=9067096>