

Paper Id	Paper Topics	Paper title	Abstract	Authors
1003	Multi Level Converters	Switched-Capacitor Multilevel Inverter with Threefold Voltage Boost and Limited Inrush Current	With the advancement of power electronics equipment and the advent of multilevel inverters, researchers have become interested in using these devices for DC to AC conversion in medium and high power applications. However, one of the challenges is the number of switching components in the inverter, which directly impacts cost and efficiency. Consequently, this necessitates the use of topologies with fewer components. With the aim of reducing the number of switching devices, this article introduces a single-phase switched-capacitor-based multilevel inverter structure. It consists of a DC input voltage source, three capacitors, eleven unidirectional switches, and one diode. This structure can generate a 13-level output waveform and boost the output voltage amplitude up to three times the input voltage amplitude. The power loss of the proposed inverter has been evaluated through simulation, and its efficiency has been calculated. A comprehensive comparison has been conducted to highlight the advantages and disadvantages of the proposed structure relative to other similar topologies. Finally, to confirm the performance of the proposed inverter, simulation results in MATLAB/Simulink were presented using level-shifted high-frequency PWM modulation.	Meysam Noori - Majid Hosseinpour - Ali Seifi
1004	New Converter Topologies	A Novel Single-stage Non-isolated Microinverter for PV systems	This paper presents a new topology for a non isolated single-stage microinverter for PV applications. The proposed structure integrates SEPIC and a buck-boost DC-DC converter, both operating in DCM to improve efficiency and stability. The topology employs four power switches, including two high-frequency devices and two low-frequency devices operating at 50 Hz. A common-ground configuration is adopted to eliminate ground leakage current. A simple digital control circuit ensures fast and reliable operation. The paper describes the operating principles and theoretical analysis of the proposed design. A 120 W experimental prototype with a 48 V DC input and 220 V AC output is developed to validate performance. Experimental results confirm the analytical findings and demonstrate the feasibility of the proposed microinverter for PV applications.	Elias Nadi - Mohammad Mahmoodsaleh - Ahmad Ghamsari Esfahani - Javad Chevinly - Masood Hajian - Ehsan Adib
1007	Battery Chargers and Management systems	Fuzzy Logic Controller Optimization for Battery Current Stress Reduction in Electric Vehicles Using Genetic Algorithm	This paper presents a fuzzy logic controller for energy management in a battery-supercapacitor hybrid energy storage system for electric vehicles. The proposed approach aims to reduce battery current stress, extend battery lifetime, and maintain the supercapacitor state of charge (SoC) within a desired range during standard FTP75 and NYCC driving cycles. eliminating the digital low-pass filter and simplifying the conventional control structure, the battery current profiles are significantly smoothed, reducing current stress and improving overall system efficiency and durability. Aiming to smoother current stress, the fuzzy logic membership functions are also optimized using the genetic algorithm. Simulation results indicate that this optimization reduces the battery RMS current by 20 and 12 percentages in the FTP75 and NYCC driving cycles, respectively. These reductions leads to lower power losses, improved overall system efficiency and durability.	Mosayeb Abolghasemi - Seyed Ehsan Abdollahi - Seyed Reza Abdollahi - Hossein Rezaei
1010	New Converter Topologies	Fully Soft-Switched Interleaved High Step-Up Converter with Reduced Voltage Stress Applicable to Grid-Connected Photovoltaic Systems	This article presents a new soft-switching high step-up converter, developed by synthesizing an active clamp circuit with a symmetrical coupled-inductors (CIs)-based interleaved boost topology. In the proposed topology, the voltage stress of semiconductor devices is limited to a fraction of the output voltage, and both the voltage conversion ratio and the semiconductor elements voltage stress can be optimized by adjusting the coupled-inductors turns ratios. Zero-voltage switching (ZVS) is achieved for all switches at ON and OFF states, while diodes commute under zero-current switching (ZCS) condition. These features significantly reduce conduction losses by enabling the use of high-performance semiconductor devices, thereby improving efficiency. Furthermore, the converter ensures continuous input current through the cross-connection of coupled-inductors windings and inherently recycles the leakage inductance energy. Owing to these advantages, the proposed topology offers simplified control and high efficiency, making it a promising candidate for a wide range of high step-up power conversion applications. The proposed topology superiorities are validated by simulation results.	Siamak Khalili - Mohsen Packnezhad - Hosein Farzanehfard
1012	Pulsed Power Converters and Control	A new bipolar solid state Marx generator based on inductive energy storage	Over the past few years, solid-state Marx generator circuits have received a great deal of attention. The majority of them operate on a capacitive energy storage (CES) principle, which involves charging in parallel and discharging in series. A combination of an inductive energy storage (IES) and a capacitive energy storage (CES) bipolar Marx circuit is proposed in this article, where inductors serve as the principal energy storage element. Combined with opening switches, the current of the inductors is directed in two different directions inside the resistive load, causing a bipolar pulse voltage. Each stage of the proposed bipolar Marx generator consists of a diode, a storage capacitor, a storage inductor and two IGBT switches, except the last stage, which consists of a diode, a storage capacitor and a storage inductor. The key parameters of the developed bipolar high-voltage generator show as following: input voltage of 10 V, Pulse width of about 50ns, and amplitude 0 to $\pm 1.5$ kV. The suggested generator may be improved to achieve even higher voltages by cascading switches, increasing the input voltage, increasing the output resistive load, replacing outdated components with higher voltages, or any combination.	Amin Farajzadeh - Kourosh Khalaj Monfared - Amir Abbas Shayegani Akmal

1013	Pulsed Power Converters and Control	A New Configuration for a Solid-State Bipolar Nano-Second Pulse Generator	In many pulsed power applications, high voltage and high-frequency bipolar pulses with low rise and fall times and flat tops are needed. The purpose of this article is to describe the design of a novel solid-state Marx generator that generates bipolar pulses for cancer treatment. It is proposed to build a novel bipolar high-voltage solid-state pulsed power generator without an H-bridge using only one DC power source. The suggested solid-state Marx generator generates bipolar pulses with the following characteristics: rising time of 150 ns and falling time of 500 ns, pulse width of 0.8-100 us, the repetition rate of 30 kHz (at 1.2 kV and 370 Ω), overshoot/undershoot less than 5% and amplitude of 0 to 1.2 kV. The suggested generator may be improved to achieve even higher voltages than 10 kV by adding additional stages, cascading switches, and diodes, replacing the components with higher voltages, or any combination. Charged capacitors connected in different polarities can generate bipolar high-voltage pulses in the suggested circuit design. The generator's storage capacitors are charged using a 300 V DC power supply. Through coaxial RG316 cables, the control signals produced by the microcontroller in accordance with the HV pulse parameters are sent to the power board circuit.	Amin Farajzadeh - Kourosh Khalaj Monfared - Amir Abbas Shayegani Akmal
1016	Modeling and Control of Power Electronic Converters	Nonlinear Adaptive Cascade PI Control of a Voltage-Controlled Boost Converter	The boost converter is a well-established and widely used DC–DC topology capable of stepping up the low-voltage output to higher levels. These converters are commonly applied in automotive, renewable energy systems, and in DC microgrids. This paper focuses on the control of the boost converter, aiming to enhance its dynamic performance and overall system stability. To this end, three control strategies are examined for regulating the output voltage under varying load conditions and fluctuations in the input voltage: the traditional PI controller, the cascade PI-P controller, and a nonlinear adaptive cascade PI-P controller based on gradient descent. The transient response and the tracking error between the reference and actual output voltage are used to evaluate controller performance. The adaptive PI-P controller demonstrates improved capability in handling disturbances and model uncertainties, making it well-suited for robust output and input voltage regulation.	Seyed mohammad Hosseindokht - Omid Salari - Jose Matas Alcalá
1019	Design & Optimization of Power Electronics Converters	Step by Step Design of LCL Filter for Central Solar Inverter with Hardware Verification	The LCL filter has become a preferred choice for high-power grid-connected converters due to its superior harmonic attenuation capability and compact size compared with conventional L filters. However, selecting its parameters to achieve low total harmonic distortion (THD), minimal reactive power, and stable control remains a challenging task, particularly for large-scale photovoltaic (PV) systems employing central inverters. This paper presents a comprehensive, step-by-step design methodology for an LCL filter dedicated to a central solar inverter, integrating analytical design, simulation, and hardware validation. The proposed procedure defines design constraints based on switching frequency, grid requirements, and acceptable current ripple, leading to systematic selection of converter-side inductance, grid-side inductance, and filter capacitance. Passive damping is employed and optimized to ensure system stability while minimizing power losses. A laboratory prototype of a multi-kilowatt central inverter is developed to experimentally verify the designed filter. Both simulation and experimental results demonstrate a significant reduction in current ripple and grid-side harmonics, achieving THD levels well below IEEE 519 limits. The proposed design method provides a practical and reliable guideline for engineers to implement efficient and stable LCL filters in high-power solar inverters, bridging the gap between analytical models and hardware realization.	Mohammad Pichan - Erfan Rezapahan
1021	New Converter Topologies	Ultra-High Step-Up Converter with Reduced Voltage Stress and Continuous Input Current	This paper introduces an innovative interleaved high step-up converter topology. By integrating coupled inductors (CIs) with a voltage multiplier cell (VMC) and switched capacitor (SC) technique, the proposed converter achieves a significantly enhanced voltage conversion ratio while reducing voltage stress on semiconductor components. The interleaved structure facilitates current sharing among semiconductor devices, thereby minimizing conduction losses. Moreover, Zero-Current Switching (ZCS) operation is achieved for the switches, which further improves the converter efficiency under full-load conditions. A passive clamp circuit is also implemented in parallel with the switches to effectively suppress the voltage spikes. The topology inherently recovers the energy stored in the leakage inductance and maintains continuous input current, resulting in reduced input ripple and enhanced overall performance. These characteristics contribute to a more efficient and compact converter design. A 200 W laboratory prototype is implemented to experimentally validate the converter performance and advantages.	Siamak Khalili - Hosein Farzanehfard
1022	New Converter Topologies	High Step-Up Quadratic Converter With Continuous Input Current and ZVS Operation	This paper introduces a non-isolated quadratic step-up DC–DC converter designed for applications demanding high voltage gain from low input levels. The proposed topology achieves significant voltage gain with reduced voltage stress on components, common ground between input and output, and continuous low-ripple input current. Complete zero-voltage switching (ZVS) for all switches minimizes switching losses and improves overall efficiency. Detailed operating principles, design equations, and performance analysis are provided. Simulation results validate the proposed converter high voltage gain, efficiency, and reliable soft-switching performance.	Maryam Hajilou - Mohammad Reza Gholami - Hosein Farzanehfard

1024	Modeling and Control of Power Electronic Converters	Deep Learning and Swarm Intelligence for Boost PFC: Neural Network Voltage Control with PSO-Optimized Sliding Mode	In this paper, a boost power factor correction (PFC) is proposed with focus on voltage and current controllers. The voltage of the boost converter needs to be immune against high load changes to prevent overshoot or undershoot on the load side. Moreover, the current controller is to be robust against disturbances and uncertainties to have a satisfactory current in the source side. Therefore, a deep neural network voltage controller is proposed to guarantee fast dynamic response. Furthermore, a sliding mode controller (SMC) based on error and error integral is used to mitigate the chattering of the PFC current and ensure high power quality. A PSO-based optimization algorithm is also used to tune the SMC coefficients to enhance the performance of the boost PFC. Simulation results show satisfactory performance of both voltage and current controllers under steady state and load change circumstances.	Mojtaba Mostafapour - Sajjad Yari Alghar - Alireza Jalilian
1028	Condition Monitoring in Power Electronics and Electric Drives	Impact of Gate Oxide Degradation on Current Sharing and Snubber Design in Parallel IGBTs	Paralleling power semiconductor devices such as insulated gate bipolar transistors (IGBTs) is widely adopted in high-power and high-current converters to enhance current capability and thermal performance. Despite its benefits, this configuration can lead to considerable current imbalance among devices. This study focuses on analyzing the unequal current distribution that occurs when multiple IGBTs operate in parallel. Previous research has shown that passive snubber networks provide a straightforward and cost-efficient solution for improving current sharing; however, most existing designs are derived solely from manufacturing variations and overlook degradation effects. In this paper, the influence of gate oxide aging on current distribution is thoroughly examined, and an improved snubber structure is developed to preserve current balance under both healthy and aged device conditions. The analytical analysis is verified through comprehensive PSpice simulations, which demonstrate the reliability and practicality of the proposed approach.	Negin Tavakol - Sadegh Mohsenzade
1030	New Converter Topologies	An Efficient High-Frequency Isolated Buck DC-DC Converter for DC-DVR Applications	This paper proposes a new buck DC-DC converter with a high-frequency voltage isolation transformer. The total number of components in this circuit structure is reduced, thereby significantly improving the switching device power (SDP) and the switch utilization factor compared to existing designs. The high-frequency voltage isolation transformer enables high step-down conversion with a flexible gain. Unlike almost all high-step-down converters, the proposed topology achieves a linear step-down gain function over a broad duty cycle range [0, 1]. This also remarkably reduces the controller complexities. Additionally, the converter features zero-voltage switching (ZVS) in its power switches, which, along with the reduction in component count, makes the suggested topology more efficient than existing designs. Moreover, comparisons indicate that the offered topology has lower maximum switch voltage, maximum diode voltage, and total capacitor voltage than the existing isolated buck converters. The proposed converter can be used as either a highly efficient voltage step-down regulator, a series DC voltage compensator, or a DC dynamic voltage restorer (DC-DVR) to mitigate voltage sags. Laboratory results from a 500W prototype circuit demonstrate the converter's performance as a DC-DVR.	Mahnaz Izadi - Ali Mosallanejad - Ahmad Salemnia - Alireza Lahooti Eshkevari
1034	AI in Power Converters Control and Monitoring	Deep Reinforcement Learning Approach for Voltage Regulation in Buck-Boost Converters	The buck-boost converter is widely used in battery systems, power supplies, and electric vehicles, where precise voltage regulation is essential. However, nonlinear dynamics and strong dependency on circuit parameters make its control design challenging. In this paper, a model-free control approach based on the Deep Deterministic Policy Gradient (DDPG) algorithm is proposed to achieve stable voltage regulation. The proposed controller directly learns the optimal control policy through continuous interaction with the converter environment, eliminating the need for an accurate analytical model. The DDPG agent can autonomously adapt to parameter variations, input voltage disturbances, and load changes. Simulation results in MATLAB/Simulink demonstrate that the proposed method achieves fast dynamic response, zero steady-state error, and smooth mode transition between buck and boost operations. The obtained results confirm the effectiveness and robustness of the DDPG-based control strategy for DC-DC converter applications.	Aliyeh Nasiri - Reza Farajpour - Hoda Ghoreishy
1037	Condition Monitoring in Power Electronics and Electric Drives	Ultra-Fast Localization of Switch Short-Circuit Faults in ANPC Inverter Using Minimal Current Sensors	This paper introduces an innovative method for identifying and localizing switch short-circuit faults in a three-level active neutral-point-clamped (ANPC) inverter. This approach employs measurements of internal circuit current and switching states to pinpoint the faults. Through a meticulous analysis of potential short-circuit current paths corresponding to specific switching states, two strategically significant points are defined. The selection of these points is optimized to minimize the number of sensors, differentiating it from conventional methods. The proposed technique achieves precise fault localization within 1 $\mu$ s. Notably, this cost-effective strategy is load-independent. Simulation results validate the effectiveness of the proposed method.	Aydin Mehdizadeh Gavvani - Ebrahim Babaei - Mehran Sabahi - Seyed Hamid Montazeri

1038	Control and Modulation Techniques of Power Converters	Common Mode Voltage and Zero Sequence Circulating Current Reduction in Parallel Two-Level Inverter	Parallel inverters play an essential role in today's energy systems, especially in renewable energy conversion and motor drive applications. However, they still face practical challenges such as circulating currents and common-mode voltage (CMV), which can reduce efficiency and create unwanted electromagnetic interference. Although numerous solutions have been developed, many introduce new drawbacks: some increase system complexity, others lead to higher power losses during switching, and some degrade the quality of the output waveform. In this work, an improved approach to Three-Level Space Vector Modulation (3L-SVM) is proposed, focusing on the reduction of CMV through the elimination of zero-sequence vectors. It consequently achieves a significant reduction in common-mode voltage without affecting performance in any adverse way. Simulations done on this new technique give lower values of THD, better power efficiency, and greater reliability. Therefore, the proposed technique can serve as a practical solution to enhance the performance of parallel inverters in both industrial and renewable energy systems.	Reza Farajpour - Aliyeh Nasiri - Mojtaba Sarparast - Jafar Adabi
1039	Modeling and Control of Power Electronic Converters	PI Controller Design for Interleaved Boost Converter with Direct Coupled Inductors	This paper presents the design and simulation of a Proportional-Integral (PI) controller based on the Internal Model Control (IMC) strategy for a coupled-inductors interleaved boost converter topology. The modeling process begins with deriving the nonlinear state-space equations of the converter, where the transformer current and capacitor voltage are considered as state variables. A steady-state operating point is first selected, corresponding to the average values of current and voltage. The state variables and control signal are then linearized around this point by introducing small perturbations and applying a first-order Taylor expansion. Consequently, the equations are expressed in a linearized form. Using the Laplace transform, the small-signal transfer function between the duty-cycle perturbation and the converter output voltage is obtained. The resulting transfer function represents a second-order system with a Right-Half-Plane (RHP) zero. The IMC-based tuning rules are subsequently applied to determine the PI controller coefficients, achieving a balanced trade-off between response speed, stability, and noise sensitivity. The designed controller is then evaluated under various operating conditions, including changes in output load resistance, input voltage, and reference voltage, to validate its closed-loop performance. Simulation results confirm that the proposed IMC-tuning based PI controller achieves faster transient response and reduced overshoot compared with conventional PI-controlled interleaved converters.	Seyed Sina Miramirkhany - Marzieh Kamali - Ehsan Adib
1042	Sensorless Control of Electric Drives	An Enhanced Sliding-Mode Observer-Based Sensorless Control With an Adaptive Online Parameter Estimation in SPMSMs	This paper presents a modified Sliding-Mode Observer (SMO)-based sensorless control strategy for surface-mounted permanent magnet synchronous motors (SPMSMs) with an enhanced adaptive online inductance and resistance estimation algorithm. The system utilizes a modified SMO employing a sigmoid switching function to suppress chattering and a frequency-adaptive complex coefficient filter (FACCF) to eliminate phase lag and amplitude attenuation in estimated back-EMFs. To ensure robustness under parameter variations, an improved inductance identification method is developed by extending the conventional current-difference-based approach, with the introduction of a resistance estimation loop. The proposed algorithm was implemented on a test bench and validated through MATLAB/Simulink simulations and experimental tests. Results depicted that the self-adaptive estimation scheme effectively tracks inductance and resistance variations, improves speed and position estimation accuracy, and enhances system stability compared with conventional SMO-based sensorless methods.	Armin Shabani - Amirhossien Fallah Khorshidi - Davood Arab Khaburi - Cristian Garcia - Jose Rodriguez
1047	Multi Level Converters	NSGA-II-Based Optimization of Switching Angles in a Seven-Level Self-Balanced Switched-Capacitor Inverter	This paper proposes a multi-objective optimization framework based on the NSGA-II algorithm to determine the optimal switching angles for a self-balanced switched-capacitor multilevel inverter. The optimization objectives are to simultaneously minimize Total Harmonic Distortion (THD) and a defined Error function. This Error function is formulated to minimize the deviation from the desired fundamental voltage amplitude while simultaneously suppressing dominant low-order harmonic components. The algorithm successfully generates a Pareto-optimal set of solutions, representing the practical trade-offs between harmonic mitigation and output voltage quality. Simulation results validate the proposed framework, showing a close match between the simulated THD and the calculated theoretical value. Unlike traditional single-objective methods that yield only one endpoint solution, this approach provides designers with the crucial flexibility to select an operating point from the Pareto front that precisely aligns with specific design priorities.	Maede Azimi - Kourosh Khalaj Monfared - Mohsen Hamzeh - Saeid Ahmadi
1051	Design & Optimization of Power Electronics Converters	Common-Mode Voltage Reduction in Multilevel Inverters Using SHE under DC Source Uncertainties	In this paper, a new method for minimizing common-mode voltage (CMV) in multilevel inverters is introduced. The scheme combines Selective Harmonic Elimination (SHE) with a Genetic Algorithm (GA) and Sequential Quadratic Programming (SQP) optimization to identify optimal switching angles despite DC source uncertainties. The scheme reduces CMV and Total Harmonic Distortion (THD) simultaneously to achieve high-quality output voltage even under DC input fluctuations. Simulation outputs based on MATLAB/Simulink confirm that the proposed hybrid technique effectively reduces CMV in comparison with conventional SHE techniques and improves inverter reliability as well as power quality.	Mohammed khamees Abed - Faegheh Taghipour Reyneh - Mohammadhossein Mohammadpour - Hoda Ghoreishy

1052	New Converter Topologies	Fully Soft-Switched High-Step Up Multi-Port Converter with Reduced Power Reprocessing for Hybrid Renewable Energy Applications	This paper presents a non-isolated fully soft-switched high-step up multi-input converter for renewable energy applications. In order to achieve high modularity and component sharing, a voltage multiplier cell based on switched capacitor, coupled inductors, and active-clamp techniques is attained, which is shared between all different operating modes of the proposed converter. The integrated cell mitigates voltage spikes and provides ZVS switching for all switches and ZCS switching for all diodes. In addition, it provides adjustable voltage gain and voltage stress, which results in using components with suitable characteristics. To validate the converter operation and performance, a 200W prototype with 36, 48, input ports and 400 V output at 200kHz switching frequency is implemented. The experimental results are presented to confirm the proposed topology effectiveness and soft-switching performance.	Vahid Torkzadeh - Ali Mohammadi - Hosein Farzanehfard
1053	Power Electronics in Electrical and Renewable Energy systems	Secondary MPC for Accurate Power Sharing Among Converter-Interfaced DGs	This paper addresses accurate sharing of active and reactive power while restoring frequency and bus voltages via secondary model predictive control (MPC) for converter-interfaced distributed generators (DGs) in islanded AC microgrids. Power-sharing constraints are handled using the classical alternating direction method of multipliers (ADMM) applied to a separable quadratic program with affine coupling. At each iteration, global sharing variables together with the associated dual signals are broadcast to all units, while each DG solves its local subproblem and returns its active and reactive power values. Under standard assumptions for convex quadratic programs, classical ADMM is known to converge. Time-domain simulations in \textsc{MATLAB}/Simulink on the IEEE 34-bus feeder with four converter-interfaced units show that, under step load changes and a temporary three-phase to ground fault, the scheme restores nominal frequency and voltages and achieves accurate proportional power sharing among the DGs	Masoud Karimiyan Abdar - Sadegh Vaez-Zadeh - Hamed Kebriai
1054	Power Electronics in Electrical and Renewable Energy systems	Comprehensive Analysis of DC-Link Capacitor Voltage Balancing in 1500V Solar Inverters Using Input-Series Flyback Converters	This article presents an analysis of Active Input Voltage Sharing (AIVS), a mechanism that ensures ancillary voltage balancing of DC-link capacitors in input-series Flyback Converters (ISFC), used as the auxiliary power supply (APS) of a solar inverter. The study examines the impact of key design parameters, such as switching frequency and transformer characteristics, on AIVS performance and proposes an alternative approach to avoid high peak circulating currents. The analysis incorporates the real capacitance values of the DC-link capacitors and the actual inductance of the transformer windings in the galvanically isolated auxiliary power supply. The proposed mathematical analysis is validated through simulation results in APS operation alongside a 120kVA solar inverter. The experimental results for DC-link capacitor voltage balancing with the APS operating alone are also reported, demonstrating its effectiveness in achieving precise voltage balancing for the DC-link capacitors in a solar inverter.	Mahdi Motahari - Ali Chahkandi - Farzad Tahami
1056	Design & Optimization of Power Electronics Converters	Ultra-Fast Solid State Circuit Breaker Based on SiC JFET with Flexible Controlled Current-Time Profile	Solid-state circuit breakers (SSCBs) are one of the prominent protection devices for DC distribution systems and microgrids. Generally, SSCBs are solely capable of detecting high amplitude short-circuit faults (SCFs). To protect a substantial and sensitive DC microgrid, the implementation of a flexible protection algorithm and the capability of fault current identification in an adjustability way are critical. Therefore, a flexible solid-state circuit breaker with a normally-on SiC JFET as the main static switch is proposed in this paper. Moreover, an analog-controlled current-time profile is utilized for both ultra-fast short-circuit and overcurrent protection. Additionally, a fast-starting isolated DC/DC converter is used as the protection driver. In the proposed method, a current sensor is utilized to monitor the system's current constantly. Consequently, simple adjustable fault current detection is provided for any DC microgrids. Finally, the prototype of the proposed SSCB is built and the experimental results validated the high speed of detecting and interrupting the SCF, as well as the overcurrent and inrush current faults protection ability. Moreover, two various overcurrent faults are applied to verify the flexibility of the proposed method.	Yousef Jafari Noudoshan - Hossein Torkaman - Chen Hao - Milad Babalou
1060	New Converter Topologies	A New Multi-level Inverter Topology Based on Cross-Switched T-Type Inverter	2 back-to-back T-type converters make up the novel topology of T-type symmetric and asymmetric multi-level inverters with minimal electrical equipment that is shown in this study. The four switches that link the two T-type inverters are cross-switched. The generation of greater levels relative to the quantity of devices and the use of low-power devices (low stress of electrical devices) are two significant benefits of the proposed inverter over traditional and modern multi-level inverters. The benefits of cross-square and T-type inverters are combined to create the suggested topology arrangement. To validate the suggested configuration, a thorough comparison of MLI topologies has been conducted in this research. The comparison analysis's outcome demonstrates how much better the suggested inverter is than competing models. Additionally shown are the findings from the loss simulation of the suggested inverter. The experimental findings validate the closest level modulation and the performance of the suggested configuration.	Ali Seifi - Seyed-Hossein Hosseini - Mehرداد Tarafdar Hagh - Majid Hosseinpour

1061	New Converter Topologies	An Improved Symmetric/Asymmetric Multi-level Inverter Topology Based on Ladder-Switched for Renewable Energy	Switched capacitor (SC) based converters with output voltage gain have been reported in recent years, nevertheless, in these configurations the quantity and voltage rating of switches are high. Additionally, sensors regulate the charging and discharging of capacitors in some of these structures rather than the capacitors themselves. SC inverters are often not appropriate for applications requiring high power or voltage. A new structure with 2 times voltage gain is suggested in this paper to solve these problems. Both the quantity of switches and their voltage stress are decreased in the proposed configuration. Also, the charging of the capacitors of the suggested structure is automatic and does not require additional circuits and sensors. The suggested structure is expanded as a ladder consisting of SC units, which are symmetric and asymmetric. Each SC unit requires a voltage source, a diode and a capacitor, which doubles the voltage power with the same number of electronic devices. A comprehensive comparison with recent structures is done to highlight the key features of the suggested configuration. Laboratory results of the suggested structure using a laboratory specimen for different conditions are included to verify the performance.	Ali Seifi - Seyed-Hossein Hosseini - Mehrdad Tarafdar Hagh - Majid Hosseinpour
1063	Power Electronics in Electrical and Renewable Energy systems	A Boost-Based High Voltage Gain Converter With Continuous Input Current, Common Ground and No Diodes Reverse Recovery Problems	This paper proposes a step-up DC-DC boost-based converter topology. The non-isolated, single-switch structure uses switched-capacitor technique and integrates two coupled inductors to achieve a high voltage gain. Additionally, the voltage multiplier structure effectively reduces the voltage stress on the switch and the output capacitors. In this converter, the switch achieves zero-current switching at turn-on, and all diodes turn off under ZCS, which reduces switching losses and eliminates diode reverse-recovery problems. The converter maintains continuous input current and common ground between the input and output. The simulation results, supported by theoretical analysis, confirm the excellent converter performance.	Maryam Hajilou - Saghi Safari - Hosien Farzanehfard
1064	Power Quality, EMC, Filtering and PFC	Modeling and Analysis of the Joint Impact of Gate Resistance and Load Current on the DM Noise Source in Power MOSFETS	Electromagnetic interference (EMI) in power converters employing high-speed semiconductor switches can violate regulatory standards, disturb the operation of sensitive systems, and increase filtering costs; therefore, EMI reduction is essential for system stability and compliance. Among different EMI sources, the differential-mode (DM) noise primarily originates from the drain current of the switching device, whose transient behavior determines the spectral characteristics of the conducted emissions. The DM noise spectrum is mainly influenced by two factors: the current slew rate during the turn-on and turn-off transitions, and the oscillatory behavior associated with the switching ringing events. In this work, we change the gate resistance from 10 to 100 $\Omega$ at three load-current levels (10, 25, and 40 A) and analyze the MOSFET drain current in time and frequency domains. The results show that increasing $R_G$ lowers $di/dt$ and attenuates the resonance peaks without shifting their frequencies, while only the trapezoidal breakpoints ( $f_{2,f_3}$ ) move to lower values; the EMI benefit saturates beyond 40 $\Omega$ , whereas the switching loss rises noticeably. Moreover, a higher $I_L$ raises the broadband envelope and amplifies the resonance peaks, so both $R_G$ and $I_L$ jointly set the DM-noise level and define the design trade-off between EMI reduction and efficiency.	Mohammad Jazayeri - Sadegh Mohsenzade
1065	New Converter Topologies	A New Topology of the High Step-Up Series Quasi-Z-Source Three-Level DC-DC Converter	In today's world, with the advancement of renewable energy technologies, the use of power electronic converters, especially boost converters that have the ability to reduce voltage and current ripple, is important. This paper proposes a three-level high-voltage-gain quasi-Z-source DC-DC converter suitable for interfacing with photovoltaic arrays. The advantages of this converter include input-current continuity, a shared ground reference for the load and the DC source, and reduced voltage stress across its semiconductor devices. This converter has been simulated in MATLAB/Simulink software with an input voltage set to 12 V and a regulated output voltage of 188 V. The results obtained from simulating the proposed converter illustrate its advantages.	Masoud Motamedi-Sedeh - Seyed Amir Mohammad Lahaghi - Behrooz Zaker
1067	Wireless Power Transmissions	Neural Network-Based Model Reference Adaptive Control for Wireless Power Transfer in Electric Vehicles	Wireless power transfer (WPT) systems for electric vehicle (EV) charging face significant challenges from nonlinear dynamics and load disturbances, which compromise voltage stability and efficiency. This paper proposes a neural network-based Model Reference Adaptive Control (NN-MRAC) framework tailored for series-series inductive WPT, integrating a Nonlinear Autoregressive with Exogenous Inputs (NARX) network for online system identification and a customized feedforward neural network (FFNN) for adaptive phase-shift modulation. The NARX model approximates the plant dynamics with time-delayed inputs, while the FFNN embeds these via weight transfer and Jacobian-derived gradients to minimize tracking error, addressing vanishing gradient issues through explicit backpropagation rules. A reduced-order reference model is derived using dipole cancellation, simplifying the open-loop transfer function to a first-order form while preserving transient and steady-state fidelity. Simulations in MATLAB/Simulink demonstrate the NN-MRAC's superiority over proportional-integral (PI) control, exhibiting markedly reduced overshoot and shortened settling times under reference voltage steps and load variations, thereby enhancing voltage stability, improving charging efficiency, and reducing current fluctuations in the EV battery for a smoother, safer charging process and extended battery lifespan.	Javad Shariatzadeh - Seyed Ehsan Abdollahi - Sayyed Asghar Gholamian - Jafar Adabi - Seyed Reza Abdollahi

1070	Battery Chargers and Management systems	Stabalized Polarization Voltage-Based Duty-Variied Pulsed Current Charging Profile	The optimal duty cycle of the pulsed current charging (PCC) profile could substantially enhance lithium-ion batteries (LIBs) performance. The optimal duty cycle needs to be dynamically determined according to the internal electrochemical states occurring during the charging process. To this end, the LIB polarization voltage is selected as a key factor in determining the optimal duty cycle in this paper. An Extended Kalman Filter (EKF) observer is designed to dynamically estimate the LIB polarization voltage. The stabilization of the LIB polarization voltage could give rise to the charge efficiency enhancement and accelerating the charging time. A PI controller is employed to stabilize the polarization voltage and its output generates the optimal duty cycle for the PCC profile. The simulation studies performed in SIMULINK environment are provided to demonstrate the feasibility of the proposed optimal duty cycle pulsed current charging (ODCPCC) profile.	Mohammad Reza Gholipour - Mehdi Saradarzadeh - Shahrokh Farhangi
1074	New Converter Topologies	Analytical Modeling and Steady State Evaluation of A Dual Switch High Step-Up DC-DC Converter Based on Coupled Inductors	This paper presents a novel topology for DC-DC converters with high voltage gain based on the boost structure. The converter is designed using two coupled inductors and two power switches. Furthermore, voltage stress on power switches is significantly reduced while a common ground is maintained, which facilitates practical implementation in industrial applications. System controllability is improved by the use of coupled inductors, and reliability is increased by limiting the inrush current of switches. The simplicity of analysis and design of the converter is achieved due to the limited number of operating modes (only two main modes) and the proof of analytical relationships in steady-state. This feature enables the optimization of design parameters and simulation effectively. Moreover, a remarkable voltage gain is achieved in two different operating modes. The superior performance of the proposed design in steady-state is demonstrated by comparison with conventional topologies. Finally, the stable performance of the converter under various load conditions and input source variations is confirmed by the results of accurate simulations in the PSCAD/EMTDC.	Amirreza Bahadori - Abdullah Abdullahpour - Hossein Askarian Abyaneh - Seyed Hossein Hosseini - Seyed Hossein Hosseini - Ebrahim Babaei
1075	New Converter Topologies	Switched Inductor Cell-Based Isolated Single-Phase AC-AC Converter with Inherent Commutation	In this paper, switched inductor cell-based isolated single-phase AC-AC converter with inherent commutation, is proposed. The proposed converter is capable of delivering a wide range of output voltages, with two independent control variables: the duty cycle and the transformer turns ratio. By integrating a switched inductor cell, the converter achieves a high voltage gain, allowing higher output voltage levels to be obtained even at lower duty cycles. The circuit topology of the proposed converter employs only a single high-frequency switch, which operates during both positive and negative half-cycles of the input voltage, irrespective of the input polarity. This design effectively eliminates commutation issues without the need for snubber circuits or complex commutation strategies, thereby providing inherent commutation and safeguarding the power devices from sudden voltage and current spikes. Furthermore, it significantly simplifies the switching sequence and overall control scheme. Another advantage of the proposed converter is its continuous input current, which removes the requirement for an input LC filter. In addition to the reduced number of switches, the voltage and current stresses on each switch are also minimized. Improvements in the SDP index further highlight the cost-effectiveness and practical benefits of the converter. The performance of the proposed topology has been verified through PSCAD/EMTDC simulations at various operating frequencies. The simulation results closely match the analytical predictions, confirming the accuracy and reliability of the proposed design.	Ali Mirhashemi - Deniz Zargariafshar - Ebrahim Babaei - Mehran Sabahi
1076	New Converter Topologies	A Dual-Input Dual-Path Hybrid Step-Down DC-DC Converter	Abstract—This paper presents a novel dual-input dual-path hybrid (DIDPH) DC-DC converter that integrates both inductive and capacitive power-transfer paths to achieve high conversion efficiency and a compact form factor. The proposed topology employs a flying capacitor to balance voltage stress across semiconductor devices and to suppress output voltage and current ripple. By supporting dual-input operation, the converter can draw energy either simultaneously or selectively from two independent sources, improving system flexibility and reliability, particularly in renewable energy and distributed generation applications. The converter operation is analyzed and passive component designs are derived. Simulation results based on realistic component parameters confirm that the proposed converter operation accomplishing a peak efficiency of 98% and maintaining output voltage ripple below 1% under rated conditions. Thanks to its simple structure, high power efficiency and flexible dual-source capability, the proposed DIDPH offers an effective and practical solution for renewable-energy systems, industrial automation and high-power density applications.	Negin Moradmamand Jazi - Amin Meshkat - Hosen Farzanehfard
1077	New Converter Topologies	A Single-Phase Non-isolated Buck-Boost AC-AC Converter with Bipolar Gain for DVR Applications	This paper proposes a non-isolated, single-phase buck-boost AC-AC converter for the dynamic voltage restorer application. The topology is capable of generating a symmetric bipolar output voltage gain, which, along with the buck-boost operation, makes it suitable for mitigating both voltage sags and voltage swells. The offered topology also enables stepwise control of the output voltage frequency and can operate simply as a single-phase rectifier. The converter features input current continuity; therefore, it does not require any additional low-pass filter on its input side. Compared to similar buck-boost AC-AC converters with a gain of $\pm D/(1-D)$ , the proposed topology exhibits improved efficiency, reduced total voltage and current stresses across its switches and diodes, as well as a lower switching device power indicator. This article presents the theoretical aspects of this new converter structure and evaluates its performance through experiments on a 220W hardware prototype circuit. The results show an efficiency of 96.6%.	Mostafa Karimi Hajjabadi - Ali Mosallanejad - Ahmad Salemnia - Alireza Lahooti Eshkevari

1078	Electric Motor Drives	Field Weakening -Based Control Method of PMSM for EV Propulsion System	Field-Oriented Control (FOC) based on the Field Weakening (FW) technique for improving the dynamic performance of a Permanent Magnet Synchronous Motor (PMSM) drive system is investigated and analyzed in this paper. Based on this idea, rated voltage of the motor increases toward saturation and d axis flux reduces. In this condition, Iq ramp increases to create the requested torque. Utilizing this method, extends the motor's operating speed range, reduces torque ripple, and diminishes the motor's transient state oscillations during reference speed changes. The implementation of this method is based on creating a current in the flux axis direction that opposes with the magnetic flux of the permanent magnet. Simulation results in the MATLAB-Simulink environment for a sample PMSM with a rated power of 50kw and salient pole type have been performed and demonstrate the superior performance of the proposed FW-based PMSM drive system compared the classical FOC structure in terms of speed and torque characteristics.	Hanieh Rabiee - Seyed Ebrahim Afjei - Alireza Khoshsaadat - Saeid Hasanifar
1082	New Converter Topologies	Active T-Source Half-Bridge Inverter	This study presents an active T-source half-bridge inverter design capable of enhancing voltage gain. Standard Z-source inverters can do single-stage buck-boost conversion without shooting through. However, existing half-bridge topologies often have limited boost factors and significant voltage stress on components, which makes them less useful in high step-up power conversion systems. The suggested architecture combines the best parts of T-source impedance networks and active switching methods to produce a voltage boost factor that is significantly higher than passive ones. At the same time, it puts less stress on switches and capacitors. There are inductors that are magnetically coupled together in a T-shape in the impedance network. There are also capacitors and an active switch that lets you change the boost factor. We present a comprehensive steady-state study of all operational modes, deriving closed-form equations for voltage gain, component stresses, and design parameters. A thorough comparison with current half-bridge Z-source topologies shows that the proposed inverter works better in terms of boost factor, number of components, and voltage stress distribution. Experimental results from a laboratory prototype operating at 10 kHz with a 20-volt input validate the theoretical analysis and confirm the correct functionality of the suggested topology, exhibiting remarkable alignment between estimated and measured values, with a voltage gain of 4.	Mohammadamin Aalami - Ebrahim Babaei - Mehran Sabahi
1083	Sensorless Control of Electric Drives	Online Estimation of d- and q-Axis Inductances in Interior Permanent Magnet Synchronous Motors Using High-Frequency Signal Injection in the Stationary Frame and an Enhanced Phase-Locked Loop	This work focuses on the Inductance identification of interior permanent magnet synchronous motors. Accurate estimation of d- and q-axis inductances ( $L_d, L_q$ ) is crucial for high-performance sensor less control of Interior Permanent Magnet Synchronous Motors (IPMSMs), especially at low speeds. This paper presents a novel method for simultaneous online estimation of $L_d, L_q$ using high-frequency (HF) sinusoidal voltage injection in the stationary $\alpha\beta$ reference frame. Unlike conventional approaches that rely on the rotating d-q frame and require rotor position knowledge, the proposed technique operates entirely in the stationary frame, eliminating the need for position feedback. By injecting a high-frequency voltage signal and observing the resulting current response, it is found that the induced currents contain information about the motor's d- and q-axis inductances. In this paper, we propose a method that uses an Enhanced Phase-Locked Loop (EPLL) together with a set of analytical equations to extract this information and estimate both inductances simultaneously. Experimental and simulation results on a laboratory IPMSM drive confirm the effectiveness of the proposed technique, with estimation errors below 5% across a wide low-speed range. The method has been implemented on a real-time experimental platform using a Texas Instruments TMS320F28034 DSP, demonstrating its practical feasibility and robustness	Milad Kohansal - Gholamreza Arab Markadeh
1084	Battery Chargers and Management systems	A Comprehensive Port-Hamiltonian Framework for Advanced Passivity-Based Control of Battery Energy Storage Systems	The integration of battery energy storage systems (BESS) is vital for the stability and efficiency of renewable energy units. This paper introduces a robust control design for BESS using a bidirectional buck-boost DC-DC converter, grounded in passivity-based control (PBC) within the port-Hamiltonian (pH) framework. By deriving a nonlinear averaged model and casting it into a pH form, the system's passive properties are revealed. Stability is ensured through Lyapunov's method, leading to a dynamic controller that guarantees globally exponential stability. The controller employs a unified law for both charging and discharging, requiring only a single proportional gain for damping. Desired state trajectories are derived to act as dynamic compensators, and sensitivity to parameter variations is thoroughly analyzed. MATLAB simulations confirm the controller's effectiveness in tracking dynamic current references and compensating loads precisely. Compared to classical proportional-integral and sliding mode controllers, the PBC-based design offers superior transient performance, lower tracking error, and simpler tuning. This work not only delivers a high-performance control strategy but also serves as a comprehensive guide to applying pH systems and PBC theory in power electronics for modern energy systems.	Pezhman Bayat - Peyman Bayat

1085	Power Electronic Converters for Emobility	An MV-DC/LV-DC MMC-Based Dual Active Bridge Converter for Fast Charging of Heavy-Duty EVs	This work investigates a hybrid converter for ultra-fast charging of heavy-duty electric vehicles (EVs). The system combines a medium-voltage modular multilevel converter (MMC) with an active-bridge stage and employs a quasi-two-level (Q2L) modulation scheme. The converter directly interfaces an MV-DC grid with an 800 V battery bus, taking advantage of the MMC modularity and scalability while providing galvanic isolation through a medium-frequency transformer. By using Q2L modulation on the MMC AC side, the design achieves controllable voltage slew rates and reduces stress on the transformer, thereby extending its lifetime. Performance is evaluated through detailed simulations, including step changes in load and current references under constant-voltage (CV) and constant-current (CC) charging modes, with analysis of the converter's dynamic response during transients. A complete battery charging profile from 20% to 100% state of charge is also simulated, featuring a 500 A CC phase followed by a 700 V CV phase. The results demonstrate reliable operation, good dynamic performance, and a smooth transition from CC to CV, confirming the feasibility of the proposed configuration for high-power EV fast-charging applications.	Mahboubeh Khakbazan Fard - Hossein Imaneini - Nadia Tan
1088	Condition Monitoring in Power Electronics and Electric Drives	A ProtoNet-based Few-Shot Network for Scenario-Aware Multi-Fault Diagnosis of PMSMs	Reliable fault detection in Permanent Magnet Synchronous Motors (PMSMs) is crucial for ensuring operational safety and minimizing downtime in industrial systems. However, conventional data-driven models often fail to generalize across multiple fault categories, especially under imbalanced or limited training conditions. To overcome this limitation, this paper proposes a ProtoNet-based Few-Shot Network (PFSN) for accurate and interpretable multi-fault diagnosis of PMSMs. The framework incorporates a self-supervised contrastive pretraining stage and a leave-scenario-out evaluation protocol to ensure robustness against unseen operating conditions. The proposed PFSN constructs a discriminative metric space via prototype representation learning, enabling efficient classification with minimal samples. Its performance is compared with benchmark machine learning models through several comparison metrics. The results show that the proposed method achieves the highest accuracy and F1-score, with nearly perfect fault separability. These findings confirm that the PFSN provides a robust and generalizable framework for real-time PMSM fault diagnosis and can be extended to other intelligent motor health monitoring applications.	Amir Hossein Baharvand - Sina Hossein Beigi Fard - Meysam Doostzadeh
1089	New Converter Topologies	A Single Switch High Voltage Gain Quasi-Z-Source Converter With Low Switch Voltage Stress	This paper introduces a non-isolated single-switch high step-up DC-DC converter. This advanced topology utilizes the combination of three winding coupled inductors with a passive clamping auxiliary circuit. This structure achieves extreme voltage gain while employing clamping circuits for leakage inductance energy recycling. The leakage inductance, on the other hand, solves the output diodes reverse recovery problem effectively. A detailed steady-state analysis is carried out, and the converter performance is compared with existing high-gain counterparts. Furthermore, the simulation results obtained by PSpice for an input voltage of 48 V, an output voltage of 400 V, and an output power of 200 W validate the effectiveness of the proposed converter.	Faezeh Bahari - Maryam Hajilou - Hosein Farzanehfard
1091	Battery Chargers and Management systems	Design of a Fifth-Order Load Resonant Converter for Battery Charging Application	Constant Current-Constant Voltage (CC-CV) battery charging profile is the most popular methods for charging lithium-ion batteries. This feature can be achieved through various approaches for dc-dc stage of the chargers. The proposed method in this paper is based on a fifth-order Passive Resonant Tank (PRT) topology that can operate in two distinct frequency points corresponding to the CC and CV modes. To achieve dual-mode operation, high-order resonant tanks are required, in which have both CC and CV regions. The design method is based on achieving output current independence from load variations at a specific switching frequency; so the necessary conditions for load-independent operation of the PRT tank are derived. Based on this criterions, the output current becomes relatively stable. This response not only provides the CC characteristic but also ensures the CV characteristic. As the second design parameter, reactive power minimization within the resonant tank is considered. The components value is determined for a 300 kHz, 54 KW converter with a 15 A output current, which are used as a sample design and simulation purposes. The proposed converter exhibits robust load regulation, minimum reactive power, and Zero Voltage Switching (ZVS) on the inverter switches over a wide load range.	Daniyal Mahmoodi - Ebrahim Afjei - Alireza Khoshsaadat
1092	New Converter Topologies	Single-Switch Soft-Switched Quasi-Resonant DC-link PWM Inverter	This paper presents a quasi-resonant DC-link inverter with a simple auxiliary cell to provide zero-voltage-switching (ZVS) during both turn-on and turn-off moments of the inverter main switches. By applying only one auxiliary switch and two resonant elements ZVS condition for all inverter switches is ensured, resulting in improved efficiency. The theoretical operation analysis and comparison with existing methods in literature is discussed. Finally, the effectiveness of the proposed quasi-resonant DC link inverter is verified by the simulation results.	Marzieh Mohamamdi Jouzdani - Hosein Farzanehfard

1093	Power Electronics in Electrical and Renewable Energy systems	Design and Implementation of an Adaptive Droop Control Strategy for Accurate Power Sharing in DC Microgrids	Direct current (DC) microgrids (MGs) are becoming increasingly important due to their efficiency, reliability, and capability to integrate distributed energy resources (DERs) such as photovoltaics and energy storage systems (ESSs). A core objective in DC MGs with parallel connected converters, such as Boost converters, is to ensure accurate, proportional power sharing among the units. The droop control method is widely adopted for this purpose because of its decentralized nature, simplicity, and lack of reliance on communication links. However, the conventional droop control scheme presents major drawbacks, including poor current sharing accuracy and voltage regulation. This paper proposes an adaptive droop based power sharing strategy for parallel connected boost converters operating in a DC microgrid (MG). The proposed method dynamically adjusts the droop coefficient based on the load current to enhance both voltage regulation and power sharing accuracy. Its performance is evaluated using two boost converters and compared with the conventional fixed-droop control under various load conditions.	Seyed Erfan Fazeli - Iman Mohammadi Moghadam - Mahdi Dashti - Mohsen Hamzeh - Kourosh Khalaj Monfared - Saeid Ahmadi
1096	Control and Modulation Techniques of Power Converters	A Robust Controller for Output Voltage of a Novel Three-switch Inverter in Photovoltaic Systems	This paper presents a new converter for photovoltaic systems to solve grid-connected issues without galvanic isolation. The proposed converter consists of a DC-DC chopper and a synchronous push-pull inverter. At the DC-DC stage, a rectified sinusoidal voltage is produced from the photovoltaic output. Then, this rectified voltage is converted to an alternating voltage by a synchronous push-pull configuration. This inverter uses only three switches to reduce total losses; one operates at a high frequency and the others at the main frequency. To decrease the ripples of the input current and the output voltage, an interleaved boost converter has been used for the DC-DC chopper instead of the classical boost chopper. To better control of output voltage, proportional-integral and sliding mode control methods have been combined. The simulation results demonstrate that the output voltage is close to the ideal sine waveform and is robust against disturbances because of applying the mentioned control approach.	Amin Torkpoor - Tohid Hashemi - Reza Mahboobi Esfanjani
1097	Design & Optimization of Power Electronics Converters	A New Topology of Active Impedance Source Inverters with a Promising Feature of Low Blocked Voltages on Semiconductors	This paper introduces a novel active impedance source inverter (AIS) topology designed to simultaneously achieve a higher voltage boost capability and reduce stress on semiconductor devices. Unlike conventional active Z-source inverters, which subject switches and diodes to high blocked voltages, the proposed topology significantly decreases the blocked voltage on the active switches and other components. A complete steady-state analysis of all operating modes is presented, including the derivation of voltage and current equations for all components. Based on this analysis, comprehensive design guidelines for passive elements and rating specifications for active devices are provided. A suitable PWM control method is also developed to ensure stable operation across both shoot-through and non-shoot-through states. Detailed simulation results confirm that the proposed inverter provides continuous input current, lower voltage stress, and an improved boost factor when compared with recent active Z-source inverter topologies. These findings validate the novelty of the circuit in achieving superior performance with substantially reduced device stress.	Vida Ranjbarizad - Ebrahim Babaei - Deniz Zargariafshar
1098	Power Electronics in Electrical and Renewable Energy systems	Advanced Control Strategy for a 10MW Grid-Connected PV System: A Comparative Study of Modified Adaptive PI and Classic PI Controllers	This paper presents an advanced control strategy for regulating grid current in a 10 MW photovoltaic power plant connected to a 20/63 kV sub-transmission substation. The plant consists of five identical generation units, each composed of PV arrays, a boost converter, a three-phase grid-connected voltage source inverter, and a 0.4/20 kV step-up transformer. Each unit is modeled in the synchronous dq reference frame to capture dynamic behavior. A modified model reference adaptive control structure is proposed to regulate the inverter's DC-link voltage and the grid currents in the d and q axes. The PI controller gains are adaptively tuned using a Lyapunov-based stability criterion to ensure convergence of tracking errors and maintain system stability under parameter variations. To maximize the extracted power from the PV arrays under fluctuating irradiance, a modified fuzzy logic-based maximum power point tracking algorithm is employed. This technique improves dynamic response and robustness compared to traditional methods. The simulation results in MATLAB validates that the proposed control approach achieves superior transient and steady-state performance while maintaining voltage stability during irradiance uncertainty. Comparative analysis confirms that the proposed controller outperforms the classic PI controllers in both accuracy and robustness.	AmirHossein Azad - Amjad Anvari-Moghaddam
1100	Electric Motor Drives	A Comparative Study of Offline Stator Inductance Estimation Methods Based on High-Frequency Sinusoidal Signal Injection via VSI	Abstract—Accurate identification of motor electrical parameters is highly important for stable and easy startup as well as for optimizing the performance of its control system. If these parameters are not identified correctly and accurately, they will cause damage to the electric motor; Therefore, finding the best offline method for estimating motor electrical parameters is considered essential. In this paper, a comparison among offline methods for estimating stator inductance using high-frequency sinusoidal signal injection through a voltage-source inverter (VSI) it is done. Generally, these methods can be classified into four categories, all of which have been simulated in the MATLAB/Simulink environment on a synchronous reluctance motor (SynRM), and their results will ultimately be compared in terms of estimation speed, method complexity, and measurement accuracy.	Mohsen Zeynali - Ali Mosallanejad - Hamidreza Pairo

1101	Power Electronics in Electrical and Renewable Energy systems	Design and Simulation of a Simplified Solar Emulator Integrating Piecewise-Linear PV Modeling and Sliding Mode Control	This paper presents the design and simulation of a simplified solar emulator based on a piecewise-linear (PWL) photovoltaic (PV) model and a sliding mode control (SMC) strategy. The proposed structure aims to emulate the nonlinear I-V characteristics of a real PV module with high accuracy and low computational complexity. A full-bridge DC-DC converter operating in bipolar PWM mode is used as the power stage, enabling accurate emulation of very low and even zero output voltages, which is essential for reproducing the constant-current region of the PV characteristic. The PWL model enables efficient real-time emulation of PV behavior under continuously varying irradiance and temperature without requiring complex numerical computations. To enhance robustness against model uncertainties and parameter variations, an SMC-based control scheme is implemented, achieving superior tracking performance compared to classical PI controllers. Simulation results in MATLAB demonstrate that the proposed solar emulator precisely reproduces PV characteristics over a wide operating range while maintaining stability and fast dynamic response under sudden changes in irradiance, temperature, and load. These features make the proposed system a practical and effective platform for real-time testing of photovoltaic converters and control algorithms.	Erfan Rezapannah - Mohammad Pichan
1102	New Converter Topologies	Isolated Step-Up Forward-Flyback Multi-Port Converter Integrating Battery Storage and PV System	This paper presents an isolated high step-up multi-port DC-DC converter (MPC). The proposed topology integrates a forward-flyback configuration with an enhanced SEPIC cell to achieve superior voltage boosting capability, full galvanic isolation, and flexible multi-directional power flow. The converter interfaces photovoltaic (PV) strings through its primary port and connects a bidirectional battery storage system (BSS) via a secondary port, enabling efficient energy exchange and grid-support functionality. Through structural integration of PV and BSS sources within a single framework, the proposed converter minimizes component count, reduces system cost, and simplifies control implementation. Moreover, it ensures low input current ripple and mitigates voltage stress across semiconductor devices. Comprehensive steady-state analyses are conducted for all operating modes, and the converter's effectiveness is verified through simulation results.	Mohammad Hosein Tehrandoost Tabrizi - Mehran Sabahi - Ebrahim Babaei - Mohammad Bagher Bannae Sharifian
1103	Electric Motor Drives	Active NPC Inverter-Fed Synchronous Reluctance Motor Drive with Fractional-Order Observer-based Model-free Speed Control	Disturbance rejection techniques have been widely employed in the speed control of electrical drives. The order of the observer impacts the dynamics of disturbance rejection. While linear observers are typically first- or second-order, this paper presents a fractional-order observer (FOO) for disturbance rejection in the speed control loop of a synchronous reluctance motor (SynRM). The FOO engages with previous samples of the disturbance to improve the dynamics of the control system. The output of the FOO is canceled in an improved model-free proportional-integral-derivative (PID) controller. Similar model-free PID controllers are applied to the current control of the SynRM in the field-oriented control (FOC) concept. The proposed SynRM drive is constructed using a three-level active neutral point clamped (NPC) inverter to make it suitable for high-power applications. A phase-shift modulation technique is employed to attain the switching sequences of the active NPC inverter. The comparative simulations are performed to demonstrate the effectiveness of the proposed method against the model-free control (MFC) with the classical disturbance identification method, and MFC with the extended state observer (ESO).	Mahdi Seyed Mousavi - Behnam Nikmram - Alireza Davari - Moslem Dehghani - Jose Rodriguez
1104	New Converter Topologies	A High Gain Common Ground Single Switch DC-DC Converter Based on Coupled Inductor With Low Input Current Ripple For Renewable Energy Applications	This research article offers a new single-switch coupled inductor based high gain DC-DC converter that is common grounded. By integrating magnetically coupled inductor, the necessity for a high-power switch duty cycle has been eliminated, resulting in reduced conduction losses. Two of main benefits for this high gain circuit is being common grounded and having Negligible input current ripple, that are essential For renewable energy uses, making this circuit suitable for applications such as PV. Moreover, incorporation of coupled inductor (CI) has enabled controlling output voltage gain by two degrees of freedom that are duty cycle and turns ratio (n) of CI. Also, it's notable to mention low number of components used in this configuration results in lower overall price and losses of circuit. The converter performance has been verified through experimental testing on a 150-watt prototype operating at a switching frequency of 50 kHz, with input and output voltages of 20 V and 240 V, respectively.	Mahsa Yadmand - Omid Ahangarzadeh - Alireza Ghasemi - Amir hossein Soltani - Ebrahim Babaei - Mehran Sabahi
1105	New Converter Topologies	Fully Soft Switched Single Stage Bridgeless Isolated PFC Converter With Low Number of Components	This paper presents an original single-stage bridgeless PFC converter, combining a boost and a flyback topology. The proposed converter employs a synchronous switch to achieve soft switching conditions for all switches and diodes. In addition, the synchronous switch reduces the output diode conduction loss. The converter provides output isolation which makes it suitable for applications requiring isolated outputs. The proposed converter is simulated by PSIM software at $V_O=70V$ , $P_O=100W$ , $f_{sw}=100$ KHZ. The simulation results indicate the achieved satisfactory THD of 12%, confirm soft switching conditions and validate the proper converter operation.	Kobra Azmand - Saeed Mohebbiyani - Hosein Farzanehfard

1108	Design & Optimization of Power Electronics Converters	A Method to Decrease the Voltage Stress on the Rectifier and Transformer of High Voltage High Power Converters Caused by the Output LC Filter	High-voltage, high-power converters play a critical role in various applications such as plasma generation and medical imaging. The output filter is a crucial element in these converters, mainly responsible for mitigating output voltage ripple, a key parameter affecting converter performance. Among different filter configurations, the LC filter is commonly adopted in this application for its strong ripple suppression capability. However, its implementation imposes additional electrical stress on the high-voltage rectifier and transformer. This paper investigates these impacts, showing that using an LC filter can result in a noticeable voltage oscillations during normal operation. Furthermore, A solution to this problem is presented which has decreased the stress about 70% in the simulation result. Both circuit simulation and transformer FEM simulation are used to verify the analysis and the proposed method.	Mohammad Qumi - Mostafa Zarghani - Shahriyar Kaboli
1109	New Converter Topologies	Design of a Single-Input Half-Bridge Impedance Source Inverter with Coupled Inductors and Continuous Input Current for Improved Voltage Gain	This study presents an innovative half-bridge impedance source inverter (HBI) that significantly enhances voltage-boosting capabilities compared to traditional Z-source inverters (ZSIs). The proposed HBI utilizes a single DC input source, achieving positive, negative and a unique zero-voltage state, which broadens its operational versatility. The design incorporates coupled inductors to optimize voltage gain while ensuring that component stresses, particularly on capacitors and switches, remain within acceptable limits. In addition, the input current remains continuous, contributing to stable operation. To thoroughly characterize the inverter's performance, four distinct operating modes were analyzed by constructing equivalent circuits for each mode. These equivalent circuits enabled the derivation of detailed expressions for voltage gain, as well as the voltage and current stresses on key components such as switches, diodes, inductors, and capacitors. Performance validation was conducted through MATLAB/Simulink simulations, which demonstrated stable and accurate output waveforms. A comparative analysis with recent inverter models further emphasizes the superior voltage gain of the proposed HBI, making it particularly well-suited for applications such as electrochemical and electroplating processes, which require high-performance and reliable voltage control.	Hossein Jafari - Mohsen Hamzeh - Ebrahim Babaei - Sadegh Vaez-Zadeh
1110	Modeling and Control of Power Electronic Converters	Asymmetrical Fault Ride-Through Capability of Single-Loop Voltage-Magnitude Controlled Grid-Forming Inverters	This paper investigates the asymmetrical fault ride-through (FRT) capability of grid-forming (GFM) inverters employing single-loop voltage-magnitude (SLVM) control. Although SLVM control offers enhanced small-signal and transient stability compared with vector voltage control (VVC), its response under unbalanced fault conditions remains insufficiently explored. To address this gap, an adaptive virtual impedance (VI) scheme is proposed to ensure compliance with the fault current contribution requirements of IEEE Standard 2800-2022. The proposed method dynamically adjusts the output impedance to limit the fault current while preserving the converter's inherent grid-forming characteristics. Simulation results demonstrate that the SLVM-controlled converter equipped with the adaptive VI maintains stable operation and effective current limitation during asymmetrical faults, without requiring inner current control loops.	Moein Haghshenas Fatmehsari - Kiarash Moady - Mohammad Hasan Ravanji - Mostafa Parniani
1113	Sensorless Control of Electric Drives	A Modified ESO-Based MPCC With an Active Flux-Based Sensorless Control on PMSMs	Model predictive current control (MPCC) for PMSM motor control has attracted the attention of researchers due to its advantages, such as easy implementation, simple equations, and high dynamic response. Compared with other conventional methods, it does not require adjustment of the regulator coefficients. Since current predictive control uses the governing equations of the motor, the accuracy of each parameter in the equation can affect the motor's performance. In this paper, in order to reduce the error caused by the mismatch between the control parameters and the real system model, an Extended State Observer (ESO) is used. The use of this observer allows the disturbances to be identified and finally eliminated in the equations. In addition, in order to minimize the cost and the wiring complexity of the sensor, an active flux observer using a combination of direct compensation and filtering by a Second-Order Generalized Integrator (SOGI) is used. The proposed method is compared to conventional MPCC and flux observer; the effectiveness is confirmed by simulation results.	Amirhossein Fallah Khorshidi - Armin Shabani - Davood Arab Khaburi - Cristian Garcia - Jose Rodriguez
1114	Electric Motor Drives	Weighting-Factor-Free Model Predictive Torque Control of Induction Motors Driven by a 3L-NPC Voltage Source Inverter	Model Predictive Control (MPC) in power electronics has gained attention over the last decades due to simple concepts and the ability to control several objectives, etc. However, tuning the weighting factor to achieve a decent performance is still a challenge in this method. In this paper a new Model Predictive Torque Control (MPTC) without a weighting factor for controlling an induction motor fed by a 3-Level Neutral Point Clamp (3L-NPC) Inverter is presented. The proposed method consists of two stages. First, it selects the voltage vectors based on balance voltage criteria; thereafter, by assessing the preselected voltage vectors in torque and flux criteria, the best option will be found. Finally, simulation results show the effectiveness of the proposed weighing-factor-free method in controlling the torque, flux, and voltage balance of the capacitors during both steady-state and transient conditions.	Mahdi Bahmani - Davood Arab Khaburi - Cristian Garcia - Jose Rodriguez
1117	New Converter Topologies	Active-Switched-Inductor Passive-Switched-Capacitor Boost DC-DC Converter	This paper proposes a modified switched-capacitor-inductor based DC-DC topology that significantly reduces the voltage stress across all switches and passive elements. Simultaneously, it provides quite high voltage gain with fewer components compared to similar designs in the literature. The source current is also continuous. Furthermore, the synchronous operation of the switches results in only two operational modes, thereby simplifying the control. The proposed structure's competitiveness and correct operation have been validated against existing solutions via comparative analysis and simulations.	Mahdi Hassan Alipour Barenji - Kazem Varesi - Ebrahim Babaei

1118	Modeling and Control of Power Electronic Converters	Dynamic Interaction Mitigation and Frequency Stability Improvement in Hybrid Grid-Forming and Grid-Following Inverters during Fault Ride-Through	The high penetration of inverter-based resources in microgrids increases stability challenges, especially during fault ride-through. In hybrid systems with parallel Grid-Forming and Grid-Following inverters, low-voltage faults cause severe dynamic interactions and frequency deviations. Conventional methods such as current limiting and active power reduction provide limited stability improvement. This paper proposes an adaptive impedance-based control that dynamically adjusts the Grid-Forming inverter's virtual impedance according to the circulating current. The proposed method enhances the dynamic interaction between the inverters, improving coordination and overall system stability. Simulations confirm improved frequency stability and reduced transients compared with conventional control.	Mojtaba Feyzi - Hasan Rastegar - Mohammadreza Aghaei
1119	Wireless Power Transmissions	Four Degrees of Freedom Wireless Power Transfer for EVs by Double-D Pads	This paper explores the performance and efficacy of an Inductive Wireless Power Transfer (IWPT) system, specifically designed for electric vehicle (EV) applications. The system leverages Self-Oscillating Controlled Inverters (SOCI) and a 2DDP magnetic coupler to achieve high transfer efficiency across a range of operational conditions. The system's performance is evaluated through simulation results, focusing on key parameters such as the coupling coefficient, transmission distance, and misalignments in both rotational and lateral directions. Results demonstrate a stable efficiency of 92% within the region of freedom (RoF), with the system capable of delivering 1 kW of output power under various misalignment scenarios. The analysis also investigates the impact of transmission distances and lateral misalignments on the coupling coefficient, offering insights into the system's adaptability. The proposed IWPT system shows promise for flexible, efficient power delivery in dynamic EV charging applications, with the potential for further improvements in real-world deployment.	Alireza Eikani - Sadegh Vaez-Zadeh - Ghasem Rezazadeh
1121	New Converter Topologies	A Novel Single-Switch Non-Isolated DC-DC Converter Employing a Switched-Capacitor Boost Network	This paper presents a novel single-switch non-isolated high step-up DC-DC converter utilizing a switched-capacitor boost network. The proposed topology achieves a significant voltage gain—approximately double that of the conventional boost converter—by employing a switched-capacitor network. This network not only increases the voltage gain remarkably, but also concurrently reduces the voltage stress across the single power switch to half of the output voltage. The converter exploits three inductors to enhance the energy transfer capability to the load for achieving a continuous input current with low ripple, suitable for renewable energy applications. Owing to its two-mode operation, the converter exhibits a simple control structure, where the output voltage can be conveniently regulated through the variation of the duty cycle. The steady-state and loss analyses confirm that the proposed converter delivers high efficiency and stable performance. A nearly 70 W laboratory prototype was developed to validate the theoretical analysis. In the end, the experimental results demonstrate an efficiency of almost 90% under full-load conditions, which verifies the merit of the proposed converter.	Armin Ghelichi - Mahdi Bahmani - Davood Arab Khaburi
1122	New Converter Topologies	A Non-Isolated Quadratic High-Gain DC-DC Converter with Reduced Switch Voltage Stress	This study introduces a non-isolated high-gain DC-DC converter. The proposed topology operates with a high voltage gain at relatively low duty cycles, which helps reduce semiconductor losses and improve overall efficiency. The design employs a single switching device, simplifying the driver circuit and ensuring a continuous input current—an essential feature for renewable energy applications. In addition to its primary objective, the converter offers benefits such as continuous input current, an optimal component-to-gain ratio, and a common ground between input and output. To further enhance voltage gain, the converter incorporates a switched-capacitor (SC) technique. Theoretical analysis and design considerations for the proposed topology are carried out under continuous conduction mode (CCM). Comparative analysis using MATLAB demonstrates that the proposed configuration significantly outperforms similar converters. Finally, simulation results obtained via PLECS software confirm the accuracy of the theoretical relationships and validate the converter's performance.	Mohsen Arabkhaeali - Aryan Khazaei - Hani Vahedi - Reza Arabkhaeali - Ebrahim Afjei
1124	New Converter Topologies	Non-Isolated Expandable Boost Converter with Diode-Switched LC Cells Achieving High Gain, Low Stress and Reduced Component Count	This paper presents an optimized non-isolated voltage-lift structure that achieves a high voltage conversion ratio by using expandable diode-switched LC (inductor-capacitor) cells. A review of existing converter structures shows that many of them suffer from the need for high duty cycles, high voltage stress on switches and diodes, and an excessive component count relative to the obtained voltage gain. To overcome these limitations, a novel converter topology is introduced. The proposed converter achieves a substantial voltage step-up while avoiding the need for extreme duty cycle operation. It also significantly reduces the voltage stress across both switches and diodes, enabling the use of lower voltage components that are more cost-effective and subject to less thermal stress. Moreover, the gain ratio per component count has been enhanced, resulting in a compact and practical design.	Reza Arabkhaeali - Hani Vahedi - Abdolreza Sheikholeslami - Mohsen Arabkhaeali

1130	Modeling and Control of Power Electronic Converters	Voltage-Frequency Control of Standalone Single-Phase Inverter Based on Adaptive Backstepping Controller with State and Nonlinear Disturbances Observers: An Experimental Validation	In this paper, an adaptive backstepping controller with a state observer and a nonlinear disturbance observer is designed to control the voltage-frequency of a standalone single-phase inverter. To improve the steady state performance and overcome the disturbances, firstly, the state observer is designed, and then a nonlinear disturbance observer is considered to estimate the disturbances in the system in order to improve the robustness and compensate more effectively. Finally, the backstepping controller is designed to control the voltage-frequency of the output voltage signal. Also, the Lyapunov theory is used to consider the closed-loop stability of the proposed adaptive controller. The performance of the proposed controller is tested on a laboratory test system with Taraz PE-RCP (TI C2000 F28379D DSP-based controller) under different kinds of loads, such as resistive, inductive, and non-linear loads. The experimental results show that the proposed controller can track the reference signal very well with low total harmonic distortion under step changes in the amplitude of the reference signal and also step changes in loads.	Moslem Dehghani - Mahdi S. Mousavi - Daniel Pesantez - Seyyed Mohammad Bornapour - Mokhtar Aly - Jose Rodriguez
1131	Design & Optimization of Power Electronics Converters	Modeling and Analysis of an Enhanced High Voltage Conversion Ratio Non-Isolated DC-DC Converter featuring low voltage stress	An enhanced non-isolated DC-DC converter topology with high step-up capability is presented in this paper. The suggested converter combines structural simplicity with superior voltage gain relative to most previously reported non-isolated high gain configurations. It is designed to minimize voltage stress on capacitors, a single switch, and diodes, while maintaining continuous input current, a unified ground connection, and low ripple at the output voltage. This paper provides a detailed steady-state mathematical analysis in continuous conduction mode (CCM), emphasizing semiconductor voltage stress and component sizing. Comparative assessments with other established converter designs further validate the improved performance of the proposed topology. The simulation outcomes of the proposed converter, obtained through PSCAD-EMTDC software, are presented to substantiate and validate the theoretical analysis.	Fatemeh Falahi - Hesamodin Allahyari - Masoud Nikbakht - Ebrahim Babaei
1132	Electric Motor Drives	Model-Free Predictive Control of Open-Winding Permanent Magnet Synchronous Motor Drive	In this paper, a Model-Free Predictive Control (MFPC) strategy is proposed for the open-winding permanent magnet synchronous motor system with a floating capacitor (FC-OW-PMSM). The proposed approach enhances the control precision compared to conventional model predictive control (MPC), which heavily depends on complete system modeling and accurate parameter knowledge. In particular, the detailed modeling of a combined battery and floating capacitor to establish two distinct DC-link voltages complicates accurate parameter extraction. Moreover, many physical parameters of PMSMs are nonlinear functions of current and rotor position, further challenging conventional MPC performance. To address these issues, the MFPC employs an optimized set of 49 voltage vectors per switching period, effectively reducing current and torque ripple while providing superior regulation of current, torque, and speed under uncertain parameter and load conditions. Simulation results demonstrate that the MFPC reduces torque ripple by $16.8\%$ , decreases current total harmonic distortion by $11\%$ approximately under parameter uncertainty tests, confirming its superior performance over standard model-based predictive control (MPC) techniques.	S. Alireza Davari - Majid Rahmani - Seyed Amir Jalalkhoshnevis - Reza Ghandehari - Mahdi S. Mousavi - Freddy Flores - Cristian Garcia - Jose Rodriguez
1133	Control and Modulation Techniques of Power Converters	Data-Driven Online Reinforcement Learning Predictive Control of Quadratic Buck Converter for Electrolyzer Application	This paper proposes a data-driven reinforcement learning (RL) control strategy for a quadratic buck converter supplying an electrolyzer load. The proposed controller is experimentally validated on a laboratory prototype. The converter's performance is evaluated under steady-state operation, load transients, parameter variations, and uncertainty conditions. Experimental results indicate that the RL-based strategy maintains stable voltage regulation, achieves approximately a $10\%$ improvement in rise time, and reduces the first inductor current by around $8\%$ compared to conventional model-free predictive control (MFPC). Furthermore, the method effectively suppresses voltage and current ripple under parameter deviations and load fluctuations, demonstrating enhanced robustness. The complete control system is implemented on a digital signal processor, confirming the practical feasibility of the proposed approach for efficient and reliable hydrogen production under dynamic operating conditions.	Majid Rahmani - S. Alireza Davari - Reza Ghandehari - Mahdi S. Mousavi - Freddy Flores - Fengxiang Wang - Jose Rodriguez
1134	New Converter Topologies	A Novel High Gain Switched-Capacitor-Inductor Embedded-Boost Z-Source Inverter	This paper presents a new topology of the impedance-source inverter (ZSI) for switched-inductor-capacitor embedded-boost-Z-source inverters (SLC-EB ZSI). The introduced configuration achieves a substantial voltage boost capability while maintaining operation at a low shoot-through duty ratio. By utilizing a reduced shoot-through duty ratio, the inverters are capable of operating at higher modulation indices, thereby enhancing output voltage performance. The input current is continuous and can be used in renewable energy sources. For both shoot-through and non-shoot-through states, a comprehensive operational analysis and mathematical analysis are conducted to determine the boost capability and design parameters for the impedance network. Simulations conducted in MATLAB/Simulink software validate the theoretical derivations. Simulation results demonstrate that the proposed inverter topology has high gain capability.	Masoumeh Gholami - Reza Noroozian - Mehran Moslehi Bajestan

1136	Power Electronics in Electrical and Renewable Energy systems	Improved Optimum Fractional Order Frequency Regulation Scheme for DFIG Wind Generation-Based Interconnected Microgrid	Conventional synchronous generator-based microgrids (MGs) possess an inherent frequency stabilization property, making them more stable in response to abrupt changes in generation or load. Recent renewables-rich MGs suffer from the continuously reducing system inertia due to the lack of a synchronous generation stabilizing effect. Power electronic converters (PECs) are crucial integration elements of renewables in MGs, considering the different output nature of renewable sources. This paper investigates the optimized design of fractional-order control schemes for improving the frequency stability of PECs based renewable energy sources in microgrid systems. Two interconnected microgrids are considered, featuring a Doubly-Fed Induction Generator (DFIG) wind energy system, a fuel cell system, and electric vehicle (EV) batteries. Renewable sources of Photovoltaics (PV), wind energy, and various loading scenarios are considered as possible disturbances of the considered MG system. A new version of fractional-order frequency control optimized using the Artificial Ecosystem Optimizer (AEO) algorithm is proposed in this paper. The results show the stable frequency regulation performance with reduced frequency nadir and response times are achieved using the proposed scheme.	Wessam A. Hafez - Sayed M. Said - Moslem Dehghani - Mokhtar Aly - Seyyed Mohammad Bornapour - Jose Rodriguez
1138	Pulsed Power Converters and Control	An Independent Rise-Time Control Scheme for Voltage and Current in IGBTs under Quasi-Zener Loads	The transient behavior of IGBTs strongly influences efficiency, reliability, and electromagnetic compatibility in power electronic systems. In Quasi-Zener loads such as magnetrons, the voltage rise-time must be kept within a specific range to prevent arcing and frequency mode jumping, while the current rise-time should be minimized to maintain waveform purity and stable operation. In this paper, the voltage and current rise-times for Quasi-Zener loads are analyzed in detail and based on the obtained results an approach is presented to achieve independent adjustment of voltage and current rise-times by adding an external gate-collector capacitor and tuning the external gate resistance. Analytical and experimental results show that the external capacitor effectively controls the voltage transition, whereas reducing the gate resistance accelerates the current rise. Furthermore, the proposed approach improves controllability of IGBT switching transients and enhances performance in pulsed-power and high-frequency applications.	Alireza Farsian - Hadi Nouri - Mostafa Zarghani
1141	Design & Optimization of Power Electronics Converters	Development of a Fully Isolated High-Frequency Induction Heater for Cost-Sensitive Applications	This paper presents a fully isolated high-frequency induction heating system optimized for cost-sensitive applications. A simplified half-bridge converter employing zero-voltage switching (ZVS) and a pulse transformer with an active Miller clamp is proposed to reduce losses and circuit complexity. The design ensures galvanic isolation and reliable operation while minimizing component count and control requirements. Experimental results validate the effectiveness of the proposed topology, demonstrating successful ZVS operation, high efficiency, and stable performance. The converter provides a compact, low-cost, and efficient solution for industrial and domestic induction heating applications.	Mahmood Khamesipour - Armin Shabani - Davood Arab Khaburi
1142	New Converter Topologies	A Novel Low-Cost Quadratic-Based High-Gain DC-DC Configuration for DC Microgrids and Industrial Applications with Experimental Validation	The paper presents a novel high step-up DC-DC converter featuring a quadratic topology tailored for DC microgrid and industrial power applications. The proposed architecture integrates two coupled inductors (CIs) with a quadratic boost network, enabling the converter to attain a remarkably high voltage conversion ratio. The main merits of this configuration include its superior voltage boosting capability, suppression of diode reverse recovery effects, significant reduction in voltage stress on the switching components, and common ground between the input and output terminals. By maintaining low voltage stress on the active switch, the converter achieves enhanced efficiency, reliability, and component longevity. A comprehensive mode-by-mode operational analysis is provided, along with a comparative evaluation against existing converter topologies to emphasize the distinct advantages of the proposed design. The converter's performance is further validated experimentally using a 255-W laboratory prototype operating at a switching frequency of 50 kHz, with an input voltage of 20 V and an output voltage of 240 V, confirming the practicality and high effectiveness of the developed approach.	Ali Nadermohammadi - Pouneh Aghakhanlou - Fatemeh Falahi - Seyed Hossein Hosseini - Mehran Sabahi - Ebrahim Babaei
1143	Design & Optimization of Power Electronics Converters	A New Bipolar Bootstrap Topology for IGBT Switches	Bipolar bootstrap topologies are used in various applications with switch legs in their topologies (such as half-bridge or full-bridge converters). This paper proposes a new bipolar bootstrap topology on the high-side (HS) switch. The proposed method uses the low-side (LS) switch as an auxiliary switch to generate the demanded voltage for the gate driver's supply. The proposed method offers constant, no ripple positive and negative voltage for the HS gate driver reference at any demanded voltage level. Furthermore, it can provide a wide range of negative voltages, which is needed for the reliable operation of different applications. The operation of the proposed method is thoroughly investigated analytically and its performance compared to other conventional bipolar bootstrap topologies are given. The optimal and reliable performance of the proposed method is explored and verified by simulation results.	Mohammad Taaleb - Iman Askarian

1144	Modeling and Control of Power Electronic Converters	Gradient Descent Model Predictive Control (GD-MPC) for Dual Active Bridge Converters	Model Predictive Control (MPC) offers fast transient response for Dual Active Bridge (DAB) converters, but conventional Moving Discretized Control-Set (MDCS) approaches suffer from quantization error, high computational cost, and complex tuning. This paper proposes a Gradient-Descent Model Predictive Control (GD-MPC) framework that overcomes these limitations. The method replaces discrete search with continuous gradient-based optimization of the phase-shift ratio and employs an adaptive learning-rate mechanism to ensure both rapid convergence during large disturbances and stable regulation near steady state. Simulation results on a 50 kHz DAB converter confirm that GD-MPC achieves superior dynamic performance, lower steady-state error, and a significantly reduced computational burden compared to conventional MDCS-MPC. The proposed controller operates with a simple, uncompensated cost function, enhancing practicality and robustness, positioning GD-MPC as an effective real-time control solution for demanding DAB applications.	Mohammad Shokrani - Ebrahim Babaei - Mehran Sabahi
1146	Pulsed Power Converters and Control	A Probabilistic Approach for Designing the Clamp-Mode Snubber in Series-Connected IGBTs	Series connection of IGBTs enables high blocking voltages, but transient voltage imbalance caused by parameter spread, temperature variation, and parasitic capacitances can overstress devices. This paper proposes a probabilistic design framework for the clamp-mode snubber that models switching subintervals and propagates device and thermal uncertainties to the injected snubber charge. From these statistics, a capacitor-sizing rule is derived that bounds voltage variation across the series stack while avoiding the conservatism of deterministic methods. Experimental evaluation confirm improved transient sharing and practical scalability without added control complexity.	Hadi Nouri - Alireza Farsian - Mostafa Zarghani
1149	Modeling and Control of Power Electronic Converters	Robust Back-Stepping Current Controller for Grid-Connected Hybrid Modular Multilevel Converter Under Grid Voltage Disturbances	In this paper, a back-stepping output current controller design is proposed for the grid-connected Hybrid modular multilevel converter (Hybrid MMC) system. The proposed output current control design strategy aims to maintain the generated current injected into the grid within the desired limits, in addition to ensuring overall stable operation of the system in the event of various grid disturbances, such as voltage sag, phase unbalance, and ground faults. The designed output current controller is systematically presented utilizing the Lyapunov-based approach to ensure the bounded convergence of the current tracking error to zero. To validate the proposed approach, simulations were conducted utilizing the MATLAB/SIMULINK environment in normal, unbalanced, and faulty grid operational modes. The results obtained from the proposed approach ascertain the proposed back-stepping current tracking controller's efficacy in ensuring fast dynamic response, high robustness, and satisfactory current regulation accuracy, ensuring successful application of the proposed approach in modern grid systems.	Hooman Mokhtari - Yousef Neyshabouri - Nazila Nikdel
1151	Condition Monitoring in Power Electronics and Electric Drives	DC-Link Capacitor Condition Monitoring Based on Artificial Neural Network in Photovoltaic Inverter	In power electronic converters, the DC-link capacitor is one of the least reliable components, often at risk of degradation due to aging and operational stresses. This paper proposes a method employing an artificial neural network (ANN) to estimate the DC-link capacitance and equivalent series resistance (ESR) in a single-phase photovoltaic (PV) inverter. The proposed ANN model is trained using the DC-link voltage ripple and the inverter output current injected into the grid, which reflect the capacitor's operating conditions, enabling the ANN to estimate variations in capacitance and ESR without additional hardware and sensors. The effectiveness of the method is verified through detailed simulations validation under diverse operating scenarios. Results demonstrate that the ANN-based approach not only achieves higher estimation accuracy than conventional techniques, with average errors of 1.74% for C and 5.94% for ESR, but also exhibits robust performance under varying environmental conditions.	Mohammad Mahdi Abbasikia - Ali Behrooz - Mojtaba Esmaeili - Mohammad Reza Zolghadri
1153	Design & Optimization of Power Electronics Converters	Enhanced Common-Ground Single-Switch Ultra-High Step-Up DC-DC Converter Based on Dual Coupled Inductors	This paper presents an ultra-high voltage gain DC-DC converter topology integrating a coupled inductor (CI) with a quadratic boost configuration and voltage multiplier cells, specifically engineered for renewable energy systems. The proposed design achieves exceptional voltage amplification while maintaining continuous input current with low ripple, making it ideal for photovoltaic and fuel cell applications. Key advantages include significantly reduced voltage stress (VS) on semiconductor devices, a common ground (CG) between input and output ports, and inherent soft-switching capabilities that minimize switching losses and diode reverse recovery issues. The voltage gain (VG) can be flexibly adjusted through both the duty cycle of the main switch and the turn ratio of the two-winding CI, offering enhanced design versatility. The converter employs synchronized switching operation and utilizes the leakage inductance of the CI to achieve zero-current switching for most diodes, thereby reducing electromagnetic interference. A comprehensive steady-state analysis and comparison with existing high-gain topologies demonstrate the superior performance and efficiency of the proposed configuration. Simulation results obtained at 50 kHz, converting an input voltage of 20 V to an output voltage of 450 V, validate the theoretical analysis and confirm the feasibility of the proposed design.	Mohammad Mostafa Kahaki - Saeed Hasanzadeh

1155	Condition Monitoring in Power Electronics and Electric Drives	Fault Diagnosis of AC–DC Converters in Series Hybrid Electric Vehicle Power Supplies using Convolutional Neural Networks	Abstract—This study proposes a convolutional neural network (CNN)-based approach for fault diagnosis in the AC–DC converters of series hybrid electric vehicle (SHEV) power supplies, focusing on open-phase faults in thyristor switches. These faults, arising from switching device failures, can degrade system efficiency and safety, necessitating robust detection amid varying operating conditions. A novel fault signature is extracted from the DC-bus current, distinguishing healthy from faulty states across five fault severity groups (one to four simultaneous switch failures). The CNN architecture processes data as 1D input features, leveraging convolutional layers for hierarchical pattern learning, pooling for dimensionality reduction, and fully connected layers for multi-class classification of fault severity. The model achieves 98.29% accuracy in classifying faults, outperforming traditional ANN baselines by capturing spatial hierarchies in spectral data with reduced computational overhead.	Mahmood Moghadasian - Seyed-Saeid Moosavi-Anchehpoli - Moslem Rahimpour
1156	Power Supplies	Uninterruptible Power Supply With Hybrid Energy Storage System	The use of an uninterruptible power supply (UPS) has been introduced as an efficient solution to provide power during a grid outage. Online UPS is used for instantaneous transfer between normal and backup modes. In UPS, batteries are used due to their high energy density. Batteries have a short lifespan and age if exposed to sudden current changes. For this purpose, a hybrid storage device is used in the proposed system. The use of a supercapacitor (SC), due to its very high charge and discharge cycles, high power density, and ability to withstand transient fluctuations alongside the battery, leads to increase in response time during a grid outage and an increase in battery life. In this paper, the rule-based control (RBC) method, is used to control the storage devices, which includes a low pass filter and a set of control rules. The advantages of this method include simplicity, separation of high and low frequency components, low cost, high efficiency and high speed. By comparing the simulation results of the proposed system and the system without SC in MATLAB software; the proposed system has a better dynamic response and reduces the battery current stress and increases its lifespan.	Mohammad Mahdi Izadi Alamshiri - Hoda Ghoreishy - Ehsan Farrokhi
1158	New Converter Topologies	A Non-Isolated High Voltage Gain Quadratic DC-DC Boost Converter for PV Power Application	The voltage level of renewable energy sources such as solar arrays needs to be increased to connect to the power grid. In the past, transformers were used as an intermediary system to increase the voltage of renewable energy. The use of transformers increased the volume and reduced the efficiency, which was not economically viable. To overcome these limitations, DC-DC converters have been proposed by researchers. This research introduces a DC-DC converter consists of two switches that use passive elements such as inductors, capacitors, and diodes to increase the voltage level. The suggested converter has low ripple continuous input current, high voltage gain, common ground, and simple structure, which make the converter suitable for PV applications. CCM and DCM operating modes analysis, steady-state analysis, and element design are presented in the paper. To confirm the claim made and the desirable performance of the introduced converter, simulation test results in MATLAB/Simulink are presented.	Hadi Khorramdel - Farzad Sedaghati - Hadi Dolati
1159	New Converter Topologies	A Non-Isolated Step-Up Interleaved DC-DC Converter with Voltage Multiplier Cell	A non-isolated interleaved DC-DC converter for step-up applications is proposed in this paper. The proposed converter configuration consists of an interleaved stage and a Dickson voltage multiplier cell (VMC). The reduced input current ripple and low voltage stress on the power semiconductor devices originates from the interleaved technique. Moreover, the Dickson VMC boosts the DC voltage. Low number of components, high voltage conversion ratio, continuous input current and common ground between the input and output ports makes the proposed converter suitable for renewable energy applications. Operation principle and steady state analysis of the suggested converter in continuous conduction mode (CCM) is presented. Also, the converter parameter design methodology is given. Finally, the introduced converter is simulated in PSIM software to verify the theoretical analysis. The obtained results validate converter performance.	Armineh Dastgiri - Farzad Sedaghati
1160	Electric Motor Drives	A Seven-Level Hybrid CHB Topology for PMSM Control with a Current Source Protection Scheme Using Combined SiC and GaN Switches	In this paper, a hybrid topology for PMSM motor is presented. Also, a control scheme for protection against an open circuit of a current source is proposed. For the accuracy of the results, a three-phase current source inverter with the proposed scheme was implemented in MATLAB Simulink environment and the accuracy of the results was verified. Also, in the PLECS environment, the converter with GAN and SiC switches was placed .In the proposed topology, the motor torque ripple was reduced and the motor speed followed the reference speed accurately.	Amirhossein Ramezankhani - Farzad Bodaghi - Amir Masoud Nouki - Mohammadreza Arabshahi - Sobhhan Mohamadian - Carlo Cecati

1161	Power Supplies	Analysis and Implementation of Four Quadrant Step-up DC/DC Converter Based on Modified Cockcroft–Walton Voltage Multiplier	High-voltage power supplies play a vital role in various industrial applications, including insulation testing systems, medical equipment, and battery energy storage systems (BESS). One of the most commonly used structures in high-voltage applications is the Cockcroft–Walton voltage multiplier (CWVM), which is widely adopted for high-voltage direct current (HVDC) generation owing to its high voltage conversion ratio and low component voltage stress. However, conventional designs utilize diodes, inherently restricting their operation to unidirectional power flow. In applications such as insulation testing or BESS, the unidirectional Cockcroft–Walton structure is incapable of handling the returned energy during the discharge phase. This limitation leads to considerable energy losses, reduced overall efficiency, and increased system size and weight. To enable the required bidirectional power flow and four quadrant operation, the Bidirectional Cockcroft–Walton Voltage Multiplier (BCWVM) topology is proposed, which replaces diodes with fully controlled bidirectional semiconductor switches, effectively addressing the aforementioned challenges. This paper presents the operating principle of the proposed BCWVM topology and provides experimental validation of its performance.	Iman Mohammadi Moghadam - Mohammadmahdi Fathollahi - Mostafa Zarghani - Shahriyar Kaboli
1163	Electric Motor Drives	A Novel Bidirectional Multiport SRM Drives for Electric Vehicles of Public Transportation	This paper proposes a multiport bidirectional switched reluctance motor drive for electric vehicles used in public transportation. Compared to the traditional SRM drive, the proposed design offers several advantages including improved mean torque due to multilevel voltage, flexible fault-tolerance feature for battery cells, wide speed range and flexible bus voltage. The simulations are carried out in MATLAB/Simulink platform to analyze and verify the behavior and effectiveness of the proposed converter that drives a 6/4 SRM.	Tohid Taghilou - Shahin Mahdiyounrad - Mohammad Reza Azizian
1165	New Converter Topologies	Improved Novel Ultra High-Gain DC–DC Circuit Using a Coupled Inductor for Renewable Energy Applications	This paper introduces an innovative ultra–high step-up DC–DC converter based on a quadratic configuration specifically designed for renewable energy systems. The proposed topology employs a single three-winding coupled inductor, enabling the achievement of an exceptionally high voltage conversion gain. Key advantages of the design include outstanding voltage boosting capability, effective mitigation of diode reverse-recovery issues, substantial reduction in voltage stress across switching devices, and a shared ground between input and output sides. By ensuring low voltage stress on the active switch, the converter delivers improved efficiency, reliability, and prolonged component lifespan. A detailed mode-by-mode analysis of the operating principle is presented, complemented by a comparative study with existing converter structures to highlight the distinctive benefits of the proposed solution. Experimental verification is carried out using a 400-W prototype operating at 50 kHz with an input voltage of 20 V and an output voltage of 400 V, validating the converter's feasibility and superior performance.	Reyhaneh Nazarzadeh - Pouneh Aghakhanlou - Ali Nadermohammadi - Seyed Hossein Hosseini - Ebrahim Babaei - Mehran Sabahi
1166	New Converter Topologies	An Ultra High Gain Double-Dual-Boost DC–DC Converter Based on Switched Inductor Cells and Ripple Mitigation Technique	This paper introduces a ripple-free, ultra-high-gain, interleaved double dual boost (IDDB) converter based on a switch-inductor cell with an integrated ripple-canceling technique. The proposed topology leverages a switched inductor structure, which alternates between parallel charging and series discharging to achieve significant voltage elevation. By interleaving multiple phases, the design is optimized for high-power applications such as electric vehicles and renewable energy systems, yielding a high step-up conversion capability. To address ripple issues, a ripple mitigation strategy is employed that effectively cancels both input-current and output-voltage ripples across a range of voltage gains. Experimental validation demonstrates the converter's performance in terms of enhanced voltage gain, minimized ripple, and suitability for renewable energy applications.	Ali Akbar Moti Birjandi - Mehran Ketabi - Saeed Mohammad Hosseini Mohammad Hosseini
1167	New Converter Topologies	A High Step-up Interleaved DC-DC Converter Topology Based on Coupled Inductor	This paper introduces a new interleaved DC–DC converter with high voltage gain designed for low-voltage renewable energy applications. The proposed converter combines an interleaved configuration, coupled inductors, and a passive clamp circuit in an integrated way to overcome the common limitations of conventional high step-up converters. By recycling the leakage energy and clamping the switch voltage stress, the converter achieves a high voltage gain without the need for extreme duty cycles or high turns ratios. A steady-state analysis is carried out to derive the voltage gain and the voltage stresses on all semiconductor devices. The theoretical results are verified through detailed PSCAD/EMTDC simulations of a 260~W prototype. The simulation results confirm that the converter provides a stable high-voltage output, low input current ripple, and properly limited voltage stress across all components, making it a suitable and efficient solution for renewable energy and electric vehicle power conversion systems.	Saeed Azmoon Asmarood - Javad Shokrollahi Moghani - Hasan Rastegar
1168	New Converter Topologies	A Single-Phase Multilevel Inverter for Grid-Connected Solar Energy Systems	This work introduces a one-phase AC stage multilevel inverter for utility interfaced solar energy setup, integrating with HERIC inverter with a level-generating unit to enhance performance and reduce leakage current. The proposed inverter achieves seven voltage levels using three capacitors and power switches, offering a compact alternative to conventional topologies such as NPC, FC, and CHB inverters. Its transformerless design addresses voltage issues, reducing leakage currents in photovoltaic (PV) systems. The topology is scalable, allowing for additional voltage levels through cascading. MATLAB/Simulink simulations of a 20 kW PV system validate its performance, achieving an RMS output voltage of approximately 1100 V and yielding 3.28% THD. The presented approach design provides an alternative approach for multilevel inverter structures in grid-connected PV applications.	Farzad Mohammadzadeh Shahir - Amir Hadifar - Touhid Poursheykh Aliasghari

1171	New Converter Topologies	Development of a High-Voltage Gain DC-DC Converter with Integrated Three-Winding Coupled Inductor for Low-Power Renewable Energy Applications	This paper presents a novel non-isolated single-switch high step-up DC–DC converter suitable for low-power renewable energy applications. The proposed topology integrates a three-winding coupled inductor, a voltage multiplier network, and a passive, lossless clamp to achieve high voltage gain while maintaining continuous input current and low ripple. Soft-switching of diodes is achieved through interaction between intermediate capacitors and the coupled-inductor leakage, significantly reducing switching losses and eliminating diode reverse-recovery effects. Steady-state modeling, voltage-gain derivation, and semiconductor stress analysis are provided. According to this analysis results is achieved a voltage gain of $\approx 12.5$ and a measured full-load efficiency of above 95.84%. Comparison with relevant high-gain converters demonstrates that the proposed converter achieves high step-up with lower device stress and continuous input current. Finally, PSCAD/EMTDC simulation results validate all of the theoretical analysis.	Mohsen Zolfkhani - Abdullah Abdollahpour - Amirreza Bahadori - Seyed Hossein Hosseini - Mehran Sabahi - Hossein Askarian Abyaneh
1174	New Converter Topologies	Design and Implementation of a Novel Quadratic-Based Ultra-High Step-Up DC–DC Converter with a Three-Winding Coupled Inductor for DC Microgrid Applications	This paper proposes a quadratic-based DC–DC converter featuring a three-winding coupled inductor, designed for ultra-high voltage gain, cost-effectiveness, and high power density, particularly targeting DC microgrid applications. The proposed topology combines a coupled inductor (CI) with a quadratic step-up structure to achieve substantial voltage amplification. The converter's voltage gain can be flexibly controlled through two primary parameters: the duty cycle of the power switch and the turns ratio of the coupled inductor, offering enhanced design adaptability. Key characteristics of the proposed converter include ultra-high voltage gain, reduced voltage stress on the switching devices, continuous input current, a common ground between input and output, and high efficiency facilitated by soft-switching operation of the diodes, all while using a single switch for simplified control. The paper provides detailed insights into the operating principles, steady-state behavior, design guidelines, and efficiency evaluation of the topology. To demonstrate its advantages, the proposed converter is compared with recently reported related topologies. The practical potential of the design is validated through a 400-W experimental prototype operating at 50 kHz, with a 20 V input and 400 V output for the DC bus, confirming its high performance and feasibility.	Ali Nadermohammadi - Pouneh Aghakhanlou - Reyhaneh Nazarzadeh - Seyed Hossein Hosseini - Mehran Sabahi - Ebrahim Babaei
1177	New Converter Topologies	High-Gain, Quadratic DC–DC Boost Converter with Single Switch and Low Input Current Ripple for Renewable Energy Applications	This paper presents a high voltage gain DC–DC converter designed to increase the performance of renewable energy systems. The proposed topology uses a coupled inductor (CI), integrated with a boost converter structure, enabling substantial voltage amplification. The output voltage can be regulated by adjusting two key parameters: the duty cycle of the switching elements and the turns ratio of the CI's dual windings. This flexibility improves the converter's adaptability across different application needs. The design has several notable benefits, including a high voltage step up ratio, low voltage stress on the switch, and a common ground between input and output, which facilitates easier system integration. This converter is more efficient and effective compared to other conventional topologies. Its efficiency and functionality are verified through simulations of a 200 W prototype, operating at a 50 kHz switching frequency, which successfully boosts an input of 20 V to an output of 200 V.	Amirreza Samadi Bonab - Parisa Shirinabadi - Ebrahim Babaei - Mehran Sabahi - Kazem Varesi
1178	Power Electronics in Electrical and Renewable Energy systems	Performance Analysis of Nonlinear Backstepping DPC Strategy for BCDFIG	Due to their notable benefits, Brushless Cascaded Doubly-Fed Induction Generators (BCDFIGs) are considered as a good solution to be employed in grid-connected wind energy systems. The mostly-used control methods for these machines, are based on linear PI controllers; which suffer from numerous disadvantages. In order to solve these drawbacks, a nonlinear control strategy, i.e Backstepping Direct Power Control (DPC) is described in this paper and different aspects of its performance are analyzed for BCDFIG. The Backstepping DPC strategy regulates the active and reactive reference powers, by utilizing an appropriately defined Lyapunov function to ensure stability and convergence. After determining the control rules of the backstepping DPC method based on the Lyapunov function and BCDFIG model, the controller is simulated in MATLAB/Simulink and its advantages and features are studied from different points of view.	Mojtaba Esmaeili - Tohid Nouri - Mahyar Khosravi - Mohammad Mahdi Abbasikia - Davood Arab Khaburi - Mohammad Reza Zolghadri
1179	Power Electronics in Electrical and Renewable Energy systems	Using Model Predictive Control Method for Speed Control of Brushless DC Motor	Brushless DC (BLDC) motors are widely employed in industrial applications owing to their high efficiency, compact size, and superior dynamic performance. However, conventional PI-based speed controllers suffer from high overshoot, slow response, and poor robustness under load disturbances and parameter variations. To address these limitations, this paper presents a novel hybrid Model Predictive Control (MPC) strategy that activates predictive control only during commutation instants, where system nonlinearities are most severe, while reverting to a conventional PI controller during steady-state intervals. This approach uniquely leverages the non-commutating phase current as the control variable and employs Hall-sensor-based conditional logic to select an appropriate Linear Time-Invariant (LTI) model in real time, addressing the severe nonlinearities introduced by commutation events, which are the most critical source of system nonlinearity during switching transients. Comparative simulations demonstrate that the proposed method achieves zero overshoot, up to 40% reduction in settling time, and enhanced robustness against load disturbances, without manual tuning of control parameters. These results confirm the superiority of the proposed MPC framework over traditional PI controllers in BLDC motor speed control.	Mojtaba Esmaeili - Tohid Nouri - Hamid reza Hadian - Mohammad Reza Zolghadri

1180	Pulsed Power Converters and Control	Dynamic Analysis of a Capacitor Charger in a Pulsed Power Supply	A pulsed power supply delivers high instantaneous power with low average input power by charging storage elements such as capacitors and discharging them in short pulses. Providing stable power to the load requires a closed-loop controller, and creating an effective controller depends on knowing the system dynamics. However, the dynamics of capacitor-based pulse power supplies are often nonlinear and difficult to identify. The presented study focuses on how such systems can be modeled and analyzed for controller design. The capacitor charger and its storage capacitor are considered the main controlled system. Different data-driven identification methods, including step response and frequency domain analysis, are used to study the system dynamics. The results obtained from the circuit topology show that the system has nonlinear and non-monotonic behavior, which limits the use of linear controllers to a small operating range. Frequency analysis also reveals that resonance at higher harmonics, especially the 7th harmonic, has a strong effect on system response. Investigating these dynamics is important for designing stable and effective controllers for pulse power supplies.	Sadra Kateb - Mostafa Zarghani - Shahriyar Kaboli
1181	Multi Level Converters	Generalized Matrix-based Topology for Hybrid Stacked Multicell Converter	In this paper, a new and scalable structure for multicell converters is proposed, which is presented in full detail, along with its analysis and results. The proposed topology is a Hybrid Stacked Multilevel Converter (HSM) based on the combination of self-balance cells, that can be extended to any number of rows and columns. Due to the presence of a half-bridge converter and a full-bridge converter in the output, the number of voltage levels and the voltage magnitude are quadrupled and the switches in these converters operate at a low switching frequency. Analytical expressions are derived for the number of output voltage levels, floating capacitors, and voltage ratings of semiconductor devices. The proposed topology achieves a high number of voltage levels with lower voltage stress across switches, making it suitable for medium- and high-power applications. The simulation results of the proposed structure, obtained using PSCAD software, are presented to verify the satisfactory performance of the proposed converter.	Samira Seyednezhad - Ebrahim Babaei - Mehran Sabahi
1183	Fault-Tolerant Design of Power Electronics Converters and Electric Drives	A Design Framework of Diode Rectifier in the Power Supply of Mission-Critical Applications for Resilience against Single Event Faults	In this paper, a comparison is presented between various structures of diode rectifier of DC output power supplies. This study is conducted to achieve proper reliability indices in an environment with high rate of failure due to single-event faults. DC output power supplies are widely used to supply various loads. Diode rectifiers are an inseparable part of these power supplies. The failure of rectifiers can have detrimental effects on the power supplies with mission-critical applications. The proposed framework is based on analysis of the adjacency matrix of the rectifier respective graph. This framework is promising enough to be employed for other complex power electronic systems with redundancy.	Saharsadat Davodi - Fatemeh Dehnamaki - Shahriyar Kaboli
1185	Fault-Tolerant Design of Power Electronics Converters and Electric Drives	Optimal Design of Non-exclusive Redundant Modules in DC Power Distribution Unit	Reliability of Power Distribution Unit (PDU) is very important in a number of applications such as telecommunication systems in space and remote areas in which a replacement of faulty components is difficult or impossible. In the conventional configuration, each main DC voltage regulator has its exclusive redundant module. However, if both the main and redundant module of a certain DC voltage level fail, the mission of system is stopped. It is an important drawback because the exclusive redundant modules of other voltage levels may be unused but PDU can not use them instead of faulty modules. In this paper, application of non-exclusive redundant modules is presented for solving this problem. In the proposed method, PDU consists of a number of redundant modules which can be used for any faulty An analysis based on non-homogenies Markov model is presented to compare reliability of proposed structure with conventional structure presuming non-constant failure probability for sensing and switching devices. A strategy for optimal design of the proposed method is presented.	Parnia Parhizi - Shahriyar Kaboli