

What is a switched capacitor DC-DC converter?

In contrast to the buck converter, a Switched Capacitor (SC) DC-DC converter requires only capacitors, which have a significantly higher power density and can be integrated more easily than inductors.

What is the topology of a switched-capacitor bidirectional DC-DC converter?

The topology of the switched-capacitor bidirectional DC-DC converter is shown in Fig. 5.2, employing four power switches $Q_1 - Q_4$, and a filtering inductor L . C_1 and C_2 are the energy storage capacitors, while C_{low} and C_{high} are the filtering capacitors on the low voltage side and high voltage side, respectively.

What is a switched-capacitor bidirectional DC-DC converter?

The capacitor C_2 is charged by C_1 through Q_1 and Q_3 . The switched-capacitor bidirectional DC-DC converter is applicable to energy storage devices in hybrid power systems, offering the capability to regulate charging and discharging power for batteries and super-capacitors.

How can a boost DC-DC converter be derived from an interleaved switched-capacitor?

By replacing the diodes $D_1 - D_3$ in the input-parallel output-series Boost DC-DC converter with power switches, the interleaved switched-capacitor bidirectional DC-DC converter can be derived. This modification enables energy conversion from the high voltage side to the low voltage side.

What is a three-phase interleaved switched-capacitor bidirectional DC-DC converter?

When the three-phase interleaved switched-capacitor bidirectional DC-DC converter operates in step-down mode, the energy is transferred from the high voltage side to the low voltage side. The converter can be utilized as the charging regulator for batteries/super-capacitors in the hybrid energy systems.

Which capacitors are charged and discharged during a switching state?

The capacitors C_4 and C_5 are both charged, whereas C_3 is discharged to power the load. Based on the above operating analysis, the voltages across components during each switching states can be obtained by applying Kirchhoff's voltage laws as follows.

Figure 6.1 shows the basic topology of the proposed bidirectional interleaved switched capacitor DC-DC converters. The topology of the converter consists of five switches S_1, S_2, S_3, S_4 and S_5 , capacitors C_1, C_2, C_3 and inductors L_1 and L_2 . The input voltage and current are represented as V_{low} and I_{low} , respectively. The output voltage and current are ...

of 93.75% of total peak energy-storage capability of the capacitors. but still introduces high-frequency loss and is quite restrictive in terms of operation and application. An alternative approach relies on switched capacitor circuits. Switched capacitor circuits that reconfigure capacitors between parallel and series combinations have been ...

ratio isolated modular multilevel dc-dc converter for battery energy storage systems on microgrids, in: Green Technologies Conference (GreenTech), 2016 IEEE, IEEE, 2016, pp. 24-28. ... Ali; GHABELI SANI, Sajad. Design and implementation of an interleaved Switched-Capacitor DC-DC Converter for Energy Storage Systems. Journal of Power ...

IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 33, NO. 5, MAY 2018 Interleaved Switched-Capacitor Bidirectional DC-DC Converter With Wide Voltage-Gain Range for Energy

Keywords: DC-DC Converter, Energy storage system, DC voltage source, quasi switched capacitor 1. Introduction From recent studies it has shown that DC/DC conversion devices are designed in excess when compared to other conversion devices [1]. Because of availability of abundant amount of DC current from renewable energy resources ex: solar.

Interleaved switched-capacitor bidirectional DC-DC converter with wide voltage-gain range for energy storage systems. / Zhang, Yun; Gao, Yongping; Li, Jing et al. In: IEEE Transactions on Power Electronics, Vol. 33, No. 5, 7956297, 05.2018, p. 3852-3869. Research output: Journal Publication > Article > peer-review

This paper proposes an improved dc transformer (NDCT hereinafter) based on switched capacitor with reduced switches for the integration of low-voltage dc energy storage systems and medium-voltage dc power distribution grid. The topology, phase-shift (PS) shoot-through and multiple PS modulations, and voltage, current, and power characterizations, as ...

High efficiency, high voltage transfer ratio (VTR), and low input ripple current is required in any bidirectional DC-DC converter (BDC) that plays a major role in interfacing batteries in applications like dc microgrids and electric vehicles (EVs). For meeting these requirements, a switched capacitor-based BDC is proposed to interface the battery with a propulsion system ...

Energy storage systems with a high voltage transfer ratio (VTR) play an important role in integrating modern electric power systems with large-scale renewable energy integration. ... The BDC architectures in this comparative study are an interleaved switched-capacitor bidirectional DC-DC converter for ESSs, switched-capacitor interleaved ...

This paper presents a non-isolated bidirectional dc-dc converter which is applicable in energy storage system. This type of converter comprises two sets of boost converters, cascaded with each other. At the high voltage side, a switched-capacitor cell is configured. On the converter's low voltage side, two independent inductors are replaced with one coupled inductor. Because ...

Abstract: Bidirectional DC-DC converters are critical aspects of integrating energy storage units with hybrid electric vehicle. In this brief, a new bidirectional DC-DC converter is presented based on the quasi Z-source and switched capacitor network. The proposed converter can achieve higher voltage gain in a lower duty cycle as compared to existing converters ...

Thus, the challenges faced by energy storage systems in transport vehicles have been thoroughly discussed (Farhadi and Mohammed, 2016; ... (Giread? et al., 2023) proposed a nonsolitary two-way combined switched-capacitor DC-to-DC converter for supercapacitors. This converter has the features of a common reference between the low and voltage ...

Fig. 1. Typical system schematic, with hybrid energy sources and SCC [5]. - "Digital Control of a Bidirectional DC/DC Switched Capacitor Converter for Hybrid Electric Vehicle Energy Storage System Applications"

She recently published couple of research papers on energy storage management in EV applications [98,103,116,122,165,166]. Her most recent two journals are "Digital Control of a Bidirectional DC ...

lowis the energy storage/filter capacitor of the low-voltage side. Module 1 includes power semiconductors Q 1, Q 2, and energy storage/filter inductors L 1, L 2. In addition, L 1 - Q 1 and L 2 - Q 2 form the parallel structure of the lowvoltage side. Module 2 is a switched-capacitor network, including switched-capacitor units C1 - Q3, C2 ...

Abstract--This paper compares the performance of Switched-Capacitor (SC) and inductor-based DC-DC conversion technologies. A metric to compare between the two topologies is discussed, and is used to compare switch utilization.

V-A product or capacitor energy storage. After carrying out the optimization steps above, a pair of performance metrics can be developed from the output impedance expressions in (1) and (2) to express the ratio of the ... any switched capacitor DC-DC converter, based on reactive energy storage. Since the series-parallel converter achieves

Switched Capacitor Circuit: an Emerging Alternative to the DC Power Interconnections Multi-Level and Partial Power Processing Converters-From Theory to Practice. Application of Partial ...

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work on film-capacitor-based energy buffers and switched-capacitor-based energy storage architectures. Section III details the fundamental principles of the proposed stacked switched capacitor (SSC) energy buffer architecture. A specific topo-logical implementation of this architecture and its extensions are described in section IV.

In this paper, an interleaved switched-capacitor bidirectional DC-DC converter with a high step-up/step-down voltage gain is proposed. The interleaved structure is adopted in the low-voltage side ...

We The performance of DC-DC converter with battery energy storage system is analyzed for electric vehicle applications. Methods: Electrical vehicles energy and voltage levels vary for different ...

The fossil fuel depletion and surge in electricity demand have paved the way to intense penetration of renewable energy sources, especially Solar. The growth in photovoltaic system and its peak power generation from 11 am to 3 pm, when the electricity demand is low, requires energy storage system (ESS) for efficient utilization of photovoltaic power generation. ...

Honarjoo et al. utilized coupled inductors and switched capacitors in a three-port DC-DC converter to achieve significant voltage gain, reflecting advancements in ...

Electrical energy storage technologies play a crucial role in advanced electronics and electrical power systems. Electrostatic capacitors based on dielectrics have emerged as ...

A novel high-gain switched capacitor (HGSC) DC-DC converter for carbon neutral energy applications is presented in the scientific paper. It consists of two MOSFET switches, ...

In this paper, a family of bidirectional dual-input dc/dc converters is proposed to combine a photovoltaic system and battery energy storage system. This family of converters utilizes a full-bridge, or half-bridge current-source circuit, as the primary side, and a quasi-switched-capacitor circuit as the secondary side. Depending on the power level of the primary side and voltage ...

A critical component in energy storage systems, the BDC facilitates power transfer between DC bus and the energy storage system. In the simulation focused on energy storage unit (ESU) applications, a ZVT 3L bidirectional DC-DC converter was examined using MATLAB/Simulink, considering three different EV operation modes.

A Novel and High-Gain Switched-Capacitor and Switched-Inductor-Based DC/DC Discharging Converter With Low Input Current Ripple and Mitigated Voltage Stresses

Switched Capacitor Circuit: an Emerging Alternative to the DC Power Interconnections ... For the common electric power sources, loads and storage, most of them are with the DC external characteristics, leading to the increased DC power conversion. It enhances the DC components" flexibility in the AC grids and even introduce the final ...

This paper presents the analysis and novel controller design for a hybrid switched-capacitor bidirectional dc/dc converter. ... 2.6-kJ laboratory model of the energy storage system. Moreover, the ...

A new principle for constructing small-sized capacitor DC-DC regulators that provide energy-efficient conversion and multi-zone energy regulation of hydrogen fuel cells is proposed. It consists in converting the energy of their current into the energy of a constant voltage source with further alternating changes in its

low-voltage regulation ...

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