



# Bidirectional swing mechanical energy storage

Energy storage systems play a crucial role in the overall performance of hybrid electric vehicles. Therefore, the state of the art in energy storage systems for hybrid electric vehicles is discussed in this paper along with appropriate background information for facilitating future research in this domain. Specifically, we compare key parameters such as cost, power ...

Parked electric vehicles are becoming flexible storage units. According to the Federal Environment Agency, on average, a private car is parked for 23 hours a day, and the average German driver covers only 36 kilometers per day - far less than the batteries' potential, which typically offer a range of around 350 kilometers.

Energy Storage Solutions: Inverters manage the charge and discharge cycles of batteries in energy storage systems, ensuring efficient energy use and reliable backup power. Electric Vehicles : In EV charging stations, bi-directional inverters allow for vehicle-to-grid (V2G) and vehicle-to-home (V2H) capabilities, enabling energy exchange between ...

A bidirectional inverter is an electrical device that can convert direct current (DC) to alternating current (AC) and vice versa. This dual functionality allows it to facilitate energy flow in both directions, making it a vital component in energy storage systems like flywheel energy storage, where it enables efficient charging and discharging of the storage medium.

With the development of marine exploitation, ocean robots pose a great challenge to traditional battery power supply, scavenging green and sustainable energy from the ocean environment to improve duration time and operation range has become a feasible solution. Herein, a self-powered underwater glider using a bidirectional swing-rotation triboelectric-electromagnetic ...

By incorporating multi-stability in a sphere magnet's circular travelling path, the proposed energy harvester effectively converts bi-directional low-frequency excitation into ...

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Baofeng Zhang's 38 research works with 821 citations and 1,462 reads, including: A Rotating Triboelectric Nanogenerator Driven by Bidirectional Swing for Water Wave Energy Harvesting

Herein, a self-adaptive rotating triboelectric nanogenerator (SR-TENG) with a compound pendulum and a functional gear-set is provided for wave energy harvesting. First, a ...

The steady and transient performance of a bidirectional DC-DC converter (BDC) is the key to regulating bus



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voltage and maintaining power balance in a hybrid energy storage system. In this study, the state of charge of the energy storage element (ESE) is used to calculate the converter current control coefficient (CCCC) via Hermite interpolation. Moreover, ...

8 Bidirectional DC-DC Converters for Energy Storage Systems Hamid R. Karshenas 1,2, Hamid Daneshpajoo 2, Alireza Safae 2, Praveen Jain 2 and Alireza Bakhshai 2 1Department of Elec. & Computer Eng., Queen's University, Kingston, 2Isfahan University of Tech., Isfahan, 1Canada 2Iran 1. Introduction Bidirectional dc-dc converters (BDC) have recently received a ...

In this work, a self-powered underwater glider using a bidirectional swing-rotation TENG/EMG hybrid nanogenerator has been fabricated to harvest energy from water waves. A mechanical rectification method using a novel gear escapement mechanism is proposed to convert irregular low-frequency bidirectional swing into stable high-frequency ...

Vibration with bidirectional linear motion can be transformed into bidirectional rotation after passing through the input module. ... utilizes the disengagement characteristic of one-way bearings and the energy storage characteristic of the variable inertia flywheel to improve the output power and efficiency. The centripetal force of the ...

Danger to life due to electric shock when entering the storage system Damage to the insulation in the storage system can result in fatal ground currents. May cause a fatal electric shock. Ensure that the insulation resistance of the storage system exceeds the minimum. Minimum value: The insulation resistance is: 14kΩ.

Triboelectric Nanogenerators. In article number 2202627, Peihong Wang, Jia Cheng, Zhong Lin Wang, and co-workers develop a triboelectric nanogenerator (TENG) enabled by coupling the swing-rotation switching mechanism with a potential energy storage/release strategy. This broadens the frequency bandwidth, stabilizes the output current, increases the ...

Due to the simple installation and convenient maintenance, the floating water wave energy harvesting devices have significant economic advantages. Mass power density is the most important index to evaluate the advancement of floating wave energy harvesting devices. Herein, a self-adaptive rotating triboelectric nanogenerator (SR-TENG) with a compound pendulum ...

energy in different sectors. In this paper, we describe the operational experience with one single LOHC system for bidirectional electrical energy storage at the kW scale.

Irregular and low-frequency mechanical energy, including ocean energy, is widely distributed but mostly wasted. Triboelectric nanogenerator (TENG) has been proved as a very promising ocean energy harvesting technology. However, the traditional cylindrical pendulum TENG (CP-TENG) can only work effectively in a narrow frequency bandwidth. In this ...



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Additionally, another TENG has converted chaotic water waves at frequencies as low as 0.7 Hz into bidirectional continuous rotation. However, the output current generated was only 6.13 mA, and the TENG requires power management circuits to perform functions including rectification, energy harvesting, energy storage, and voltage regulation [25 ...

Abstract. Complaint constant force mechanisms (CFMs) have been applied in many applications, e.g., end effectors, micro grippers, etc., due to their inherent ability to maintain a constant force environment and increase energy storage efficiency. However, the typically designed uni-directional, i.e. tension or compression only, CFMs may not efficiently harvest ...

Among these mechanical energy harvesters, triboelectric nanogenerator has gained huge interest due to the simple fabrication process, less cost, and high electrical output performance [4] .

Here, a robust swing-structured triboelectric nanogenerator (SS-TENG) with high energy conversion efficiency for ultra-low frequency water wave energy harvesting is ...

Request PDF | Constructing bidirectional-matched interface between polymer and 2D nanosheets for enhancing energy storage performance of the composites | Interfacial engineering, specifically core ...

For new renewable clean energy, triboelectric nanogenerators (TENGs) have shown great potential in response to the world energy crisis. Nevertheless, the alternating-current signal generated by a TENG needs to be converted into a direct-current signal to be effective in applications. Therefore, a power management circuit, comprising a clamp rectifier circuit and a ...

Triboelectric nanogeneration is a burgeoning and promising technology for harvesting low-frequency mechanical energy from the environment, but the energy conversion efficiency and service life of the triboelectric nanogenerator (TENG) device are limited by the inevitable frictional resistance between the tribo-surfaces. Herein, we propose an electrostatic ...

Herein, a self-powered underwater glider using a bidirectional swing-rotation triboelectric-electromagnetic hybrid nanogenerator (BSR-HNG) has been fabricated to harvest energy from ...

A bidirectional converter (BDC) is essential in applications where energy storage devices are involved. Such applications include transportation, battery less uninterruptible power system ...

This study develops a newly designed, patented, bidirectional dc/dc converter (BDC) that interfaces a main energy storage (ES1), an auxiliary energy storage (ES2), and dc-bus of different voltage levels, for application in hybrid electric vehicle systems. The proposed converter can operate in a step-up mode (i.e.,



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Massive introduction of dispersed energy generation systems imposes new challenges of grid stability due to the intermittent nature of the renewable energy sources, which is especially challenging in remote locations [1, 2]. Fuel cell or battery-based energy storage systems (BESSs) is an attractive solution for both

This interface typically includes a bi-directional inverter/converter and a variable speed drive. The power flowing to and from the flywheel is managed at a DC link. To connect the Flywheel Energy Storage System (FESS) to an AC grid, another bi-directional converter is necessary. This converter can be single-stage (AC-DC) or double-stage (AC-DC ...

In this work, a self-powered underwater glider using a bidirectional swing-rotation TENG/EMG hybrid nanogenerator has been fabricated to harvest energy from water ...

The annual energy storage, as the yearly total thermal energy injected into the system, is a metric to determine the system's ability to meet the heating/cooling demand [68]. Understanding the annual energy storage helps appropriately size the ATES system components, such as borehole depth and pump capacity.

The Q-U control model is designed by simulating the excitation regulation process of SG, which makes the converter possess Q-U droop characteristic gure 3 is the Q-U control structure diagram and Eq. 2 is the expression of dynamic response process of Q-U control. As can be seen from Figure 3 and Eq. 2, the Q-U control is unsimilar with to SG, which ...

Fig. 3 schematically shows the energy storage chain installed in the LOHC container. The research platform is connected to the institute's direct current (DC) grid via the DC/DC converters which were developed and built at Fraunhofer IISB [34].The DC grid is operated with a voltage of  $\pm 380$  V. When electrical energy is stored, the grid voltage is ...

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