

## SolarInvert Energy Solutions

# Inverter high frequency vibration



## Overview

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Motor shaking when driven by a frequency inverter is typically caused by encoder signal issues, mechanical resonance, high-order harmonics, or inverter-generated noise. Why do permanent magnet synchronous motors have high-frequency sideband electromagnetic force?

The utilization of inverters and pulse width modulation (PWM) technology in driving permanent magnet synchronous motors (PMSMs) introduces high-frequency sideband electromagnetic force. Consequently, the risk of PMSMs resonance inevitably increases, leading to disruptions in the operating state and increased noise radiation.

Which PWM technique is best for electric vehicle inverter & motor system?

This paper has presented a comparative analysis of the efficiency and NVH performance of various PWM techniques, including SVPWM, DPWM, and RPWM, for an electric vehicle inverter and motor system. The experimental results demonstrated that DPWM showed the highest efficiency, outperforming SVPWM by up to 2.23%.

How does a PWM inverter affect powertrain performance?

The efficiency of an inverter, which converts DC power into the AC power required to drive an electric vehicle, is essential for overall powertrain performance. Various PWM techniques are key factors in determining this efficiency.

Do sideband harmonic currents cause torque ripple?

The torque ripple caused by sideband harmonic currents is derived. Rules to reduce electromagnetic vibration are proposed. The results indicate that the sideband electromagnetic forces have both low- and high-frequency characteristics. Torque ripple shows a new high-frequency characteristic.

What is a voltage source inverter?

Overview of Electric Vehicle (EV) Inverters Voltage source inverters are commonly used in electric vehicles to convert DC power from the battery into AC power required for motor operation, as illustrated in Figure 1. The inverter consists of six switches, arranged in three arms, each responsible for producing one phase of the three-phase current.

Do sideband electromagnetic forces have high-frequency characteristics?

The results indicate that the sideband electromagnetic forces have both low- and high-frequency characteristics. Torque ripple shows a new high-frequency characteristic. Experimental findings validate the effectiveness of the proposed rules for optimizing electromagnetic vibration, resulting in an 11.1 dB reduction in the 3.5–6.5 kHz band.

## Inverter high frequency vibration

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### Power Inverter Making Noise? Here's Why and ...

Is your power inverter making a noise that's worrying or annoying? It's happened to me before too. The biggest piece of advice I can give you is to not ignore ...

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### Review of High-Frequency PWM Acoustic Noise Suppression ...

Sep 1, 2024 · The switching action of power electronic devices causes high frequency current, magnetic field, vibration and annoying noise of induction machines fed by inverters, and these ...



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### How to solve the problems of heating, vibration and noise ...

May 13, 2025 · 2) The vibration caused by mechanical reasons is manifested as: when there is an overhanging weight on the motor shaft and the natural frequency of the shaft system is ...

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## Review of High-Frequency PWM Acoustic Noise Suppression ...

Jun 13, 2024 · Permanent magnet synchronous motors (PMSMs) driven by voltage source inverters (VSIs) with pulse width modulation (PWM) are widely used. Given the impact of ...

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## Why is My Solar Inverter Making Noise? (How to ...

Nov 29, 2023 · However, low-pass filters can also introduce some distortion into the signal due to their filtering action. Another type of inverter noise filter is the ...

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## (PDF) Vibration and noise characteristics of an ...

Sep 21, 2023 · From this study, observations from NVH tests on an EV inverter is highlighted in frequency range where relatively high vibration and noise levels ...

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## Research on High Frequency Vibration Reduction Using ...

Aug 16, 2022 · This article investigates the effect of the carrier phase shifted pulsewidth modulation on the vibration

reduction of inverter-fed multiphase  
permanent magnet s

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## Analysis of High Frequency Noise of Inverter Rotary ...

Oct 13, 2020 · Compressors driven by inverters will produce high frequency noise, which will have adverse influence on total noise level. An existing compact inverter rotary compressor is ...

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## Variable Frequency Drives (VFDs) and Motor Noise

Apr 11, 2012 · The impact of changing VFD switching frequency on motor noise requires some background explanation. Variable frequency drives operate by rectifying incoming AC voltage ...

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## High-frequency vibration motors / hook base ...

Equipped with a series of high-frequency inverters (with volume control), these products can be set to a desired

frequency setting according to the product ...

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## Inverter noise

Mar 29, 2024 · When the number of intermittent full cutoff cycles per unit time reaches a considerable proportion of the total number of cycles, the vibration ...

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## Chinese Journal of Electrical Engineering-, Volume Issue

Wentao Zhang, Yongxiang Xu, Yingliang Huang, Jibin Zou. Reduction of High-frequency Vibration Noise for Dual-branch Three-phase Permanent Magnet Synchronous Motors \* [J]. Chinese ...

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## Synchronous random switching frequency modulation ...

Dec 23, 2020 · On one hand, unpleasant acoustic switching noise and mechanical vibration are generated by undesirable





high-frequency pulse width modulation (PWM) voltage and current ...

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## Forced response vibration analysis of induction motor ...

Jan 1, 2022 · Special attention is given to the high-frequency vibration near the side-band frequencies caused by the switching noise of the inverter. The finite element (FE) method has ...



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## High-frequency vibration suppression and current balance

Jul 16, 2025 · At present, carrier phase-shift PWM is a good method to suppress high-frequency vibration. However, further research is required to determine whether the chosen carrier phase ...

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## What are the causes of power inverter vibration problems

In addition, the noise generated by the



power switching devices (such as insulated gate bipolar transistors, IGBTs) inside the inverter during high-frequency switching may be transmitted to ...

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## Simulating Noise, Vibration, and Harshness ...

Jun 29, 2024 · The key to managing NVH in electric vehicle powertrains is understanding the noise from electric motors, inverters, and gear systems. ...

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## Eliminate Noise from a Motor with an Inverter

Inverters rectify ac to dc then chop it up again with transistors to provide a variable frequency, variable voltage pseudo ac to create a variable speed ...

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### ESS



## Understanding Inverter Noise: Why Does Your ...

5 days ago · The process of changing the frequency in an inverter using PWM (Pulse-Width Modulation) technology can

produce a fairly loud sound. This is ...

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## Research on High Frequency Vibration Reduction Using

Aug 28, 2024 · This article investigates the effect of the carrier phase shifted pulsewidth modulation on the vibration reduction of inverter-fed multiphase permanent magnet ...

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## PWM harmonics reduction for dual-branch three-phase ...

Nov 1, 2023 · High-frequency pulse width modulation (PWM) acoustic noise is generated by PWM switching harmonics in the dual-branch three-phase permanent magnet synchronous motor ...

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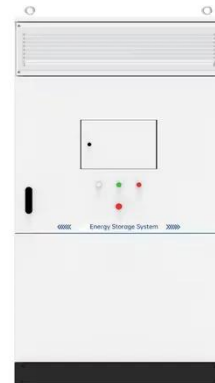


## High frequency vibration of inverter-fed PMSM and its ...

The high-frequency vibration experiments are conducted on a surface

mounted 8-pole and 12-slot PMSM. The high-frequency vibrations near switch frequency and its multiples are main ...

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## AN EXPERIMENTAL INVESTIGATION OF ELECTRIC ...

The paper presents an approach to identify and analyze vibrations caused by inverter operation at different switching frequencies. Proper detection of vibrations may be used to fine-tune inverter ...

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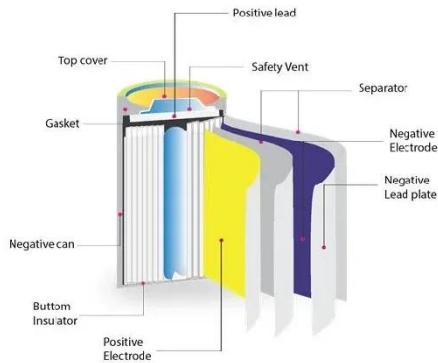
## Troubleshooting Guide Abnormal Noise from Inverter: ...

Nov 28, 2024 · Inverters operating at high or full power sometimes exhibit abnormal noises, ranging from subtle to more pronounced sounds. What causes these issues, and how can they ...

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## Analysis of Efficiency and Noise, Vibration, and ...



Nov 23, 2024 · The objective is to evaluate the impact of these PWM techniques on inverter and motor efficiency, as well as their effects on NVH performance, ...

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## (PDF) Simulating Noise, Vibration, and Harshness

Aug 14, 2024 · Noise from electric motors, mainly resulting from electromagnetic forces and high-frequency noise generated by inverters, significantly impacts overall NVH performance.



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## Research on High Frequency Vibration Reduction Using ...

Aug 16, 2022 · This article investigates the effect of the carrier phase shifted pulsewidth modulation on the vibration reduction of inverter-fed multiphase permanent magnet ...

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## Vibration and noise characteristics of an inverter

...

Sep 21, 2023 · Hence it can be concluded that AC current ripples cause high level of vibration and acoustic noise response around switching frequency of ...

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## Why Does the Motor Shake When It Is Driven by ...

Aug 14, 2025 · When a motor is driven by a frequency inverter, also known as a variable frequency drive (VFD) or variable speed drive, it may experience ...

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## Analysis of Efficiency and Noise, Vibration, and ...

Nov 23, 2024 · This study investigates the efficiency and noise, vibration, and harshness (NVH) characteristics of electric vehicle (EV) powertrains based on ...

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## High frequency vibration of inverter-fed PMSM and its ...

Permanent magnet synchronous motors (PMSM) generate high-frequency electromagnetic vibration and noise

when powered by inverters and the cause is high-frequency ...

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## Inverter Making Noise? Common Causes and ...

Apr 21, 2025 · High-end inverters use better internal components, which reduce coil vibration and fan noise. Some models also include noise-dampening ...

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## Vibration Analysis of Traction Drive System ...

Oct 14, 2023 · The results of the traction motor field vibration test showed that 100 Hz vibration frequency occurred during traction and braking of high-speed ...

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## (PDF) Reducing High-Frequency Vibration in Inverter-Fed ...

The high-frequency vibrations near

switch frequency and its multiples are main components of vibrations of motors when powered by inverters, and experiments are conducted to study the

...

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## High-frequency vibration suppression and current balance ...

Jul 16, 2025 · This article introduces a spatial-harmonic model for analyzing high-frequency vibrations induced by PWM-current harmonics in inverter-fed surface permanent magnet ...

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## Analysis of Electromagnetic Vibration in ...

Mar 22, 2025 · High vibration noise limits the application of permanent magnet motors in electric locomotive traction. This paper focuses on the high ...

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