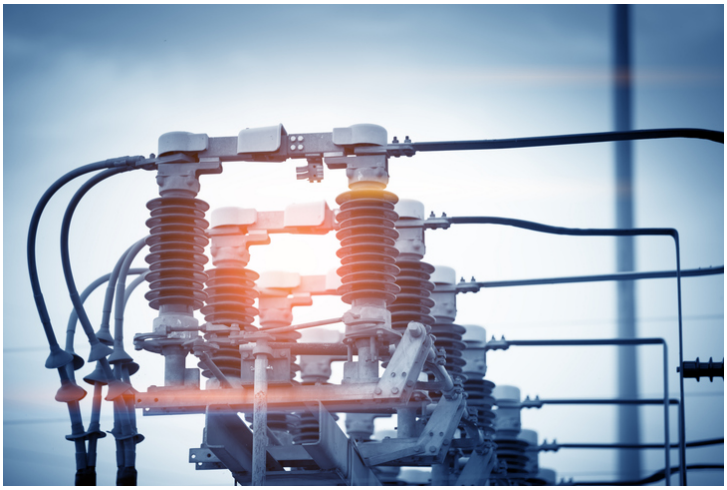
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Nonlinear Resonance Circuit for Wireless Power Transmission and Electromagnetic Energy Harvesting

TECHNOLOGY NUMBER: 6537



OVERVIEW

Nonlinear resonator circuits for efficient wideband wireless power harvesting

- Significantly increases tolerance to variations in alignment and distance
- IoT devices, structural health monitoring, Smart Dust networks, environmental sensors

BACKGROUND

Wireless power harvesting (WPH) captures ambient electromagnetic energy to power devices without wires or batteries. Traditional solutions involve linear resonators with high quality factors to amplify incoming signals for conversion into usable power. Despite their effectiveness at boosting signal levels, these resonators suffer from a fundamental limitation: a narrow operational bandwidth. This narrowness makes them susceptible to detuning and inefficiency due to environmental factors like temperature changes, humidity, and physical alterations over time. To mitigate such issues, frequency-tracking circuits are sometimes added to linear resonators, but these can consume valuable energy, rendering them impractical for low-power applications. Therefore, there is a pressing need for a technology that maintains high energy capture efficiency over a broader bandwidth without such significant power penalties, ensuring long-term, maintenance-free operation in a variety of challenging settings.

Technology ID
6537

Category
Hardware
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

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INNOVATION

Researchers at the University of Michigan have developed nonlinear resonator circuits for wireless power transfer. By utilizing a resonator described by the Duffing Equation, this system maintains a high resonance amplitude across a significantly wider bandwidth than traditional linear resonators. The technical advancement lies in its nonlinearity, which provides a self-adjusting mechanism that enhances bandwidth without incurring additional energy costs typical of frequency-tracking systems. The Duffing resonator's unique capability to "tilt" the resonance peak ensures stable performance even as external factors vary.

ADDITIONAL INFORMATION

REFERNCES

"Bandwidth Enhancement of RF Resonators Using Duffing Nonlinear Resonance for Wireless Power Applications"

INTELLECTUAL PROPERTY

US10199869 "Nonlinear resonance circuit for wireless power transmission and wireless power harvesting"

US10784723 "Nonlinear resonance circuit for wireless power transmission and wireless power harvesting"