Hybrid Electromechanical Metamaterials for Optical and Electrical Devices

Tech ID: 29323 / UC Case 2018-497-0

ABSTRACT

Researchers at the University of California, Davis have developed a hybrid electromechanical metamaterial for use in high frequency applications for optical and electrical devices.

FULL DESCRIPTION

High frequency filters and oscillator circuits utilize mechanical resonances to absorb or emit electromagnetic energy. Currently, these types of integrated circuits use piezoelectric materials that must be micromachined and tuned to achieve a desired frequency response. Generally, the resulting frequency produced is insufficient and additional circuitry is necessary to clean up the response, taking up additional space and increasing the cost of the overall circuit.

Researchers at the University of California Davis have developed a hybrid high frequency vibrational metamaterial for use in optical and electrical devices. This superlattice metamaterial is composed of molecules and nanoparticles and can resonate in response to optical, plasmonic, electrical, thermal, or mechanical stimulation. By modifying the individual particles, a specific resonance can be achieved between 100 MHz to 2 THz. Moreover, the metamaterial exhibits a high quality factor (Q Factor), improving power efficiency and eliminating the need for costly additional circuitry.

APPLICATIONS

- Waveguides, antennas, phononic crystals, frequency separators (superprisms), and optical devices with tuned absorbance characteristics
- WiFi, GPS, Bluetooth, and other radio based connectivity
- Electrical and optical devices
- Active or passive cooling
- THz imaging
- Biosensing

FEATURES/BENEFITS

- Decreases the complexity of circuit designs by working with pure frequencies
- Tunable resonant frequencies between 100 MHz and 2 THz
- Utilizes compositional changes, not micromachined piezoelectric materials
- May reduce the cost and size of oscillator circuitry
- May result in improved power efficiency

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,640,014	05/02/2023	2018-497

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OTHER INFORMATION

KEYWORDS

RF/mm-wave, metamaterials, phononics, photonics, high-frequency oscillator, resonator, notch filter

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Materials & Chemicals**
  - Other
- **Nanotechnology**
  - Electronics

RELATED CASES

2018-497-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Reversed Feedback Amplifier Architecture
- Ultra-High Range Resolution Doppler Radar Front End With Quadrature-Less Coherent Demodulation
- On-Chip Platform for Single-Molecule Electrical Conductance Measurements
- A Combined Raman/Single-Molecule Junction System For Chemical/Biological Analysis
- Field Effect Bipolar Transistor
- Low Energy and Noise Sub-Sampling Phase-Locked Loop
- Rapid and Sensitive Detection of Microbial RNA directly from Blood Samples by Electrical Biosensors

- Broadband Light Emission with Hyperbolic Material
- High-Frequency Imaging and Data Transmission Using a Re-configurable Array Source with Directive Beam Steering
- DNA-based, Read-Only Memory (ROM) for Data Storage Applications
- Phased-Locked Loop Coupled Array for Phased Array Applications
- RNA-based, Amplification-free, Microbial Identification using Nano-Enabled Electronic Detection
- Scalable Phased Array Standing Wave Architecture
- Embedded Power Amplifier
- Reducing Electrical Current Variations in Phase-Locked Loop Systems

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