Phononic Crystals with Adiabatic Transitions for Full Acoustic Confinement in MEMS Resonators

Technology #18400

Applications

- Communications and radio frequency (RF) applications
- Electronic systems needing sharp and monolithically integrated filters
- Solid state high-Q MEMS resonators
- Timing and clocks
- Modulating lasers for on-chip optical waveguides
- Narrow-band lasers and optical filters

Problem Addressed

MEMS resonators are high-Q, narrow-band filters are used in communications and RF applications. The high-Q, narrow-band filters lead to a more selective filter and the oscillators have a lower phase noise over conventional designs. However, current designs are not fully solid-state and require post processing which cannot be fully integrated.

Technology

The invention is a novel way of guiding elastic waves and confining mechanical vibrational energy using phononic crystals and adiabatic (slow) transitions in a completely solid-state commercial CMOS stack. This requires that phonons, quanta of sound, are completely contained within the CMOS die. The result is a 35 times improvement in the Q-factor of the phononic crystal CMOS resonant body transistors (PnC-CMOS RBTs). The invention can also be used as a phononic trap or coupled with on-chip micro- and nano-photonics to achieve on-chip opto-mechanical coupling. The invention is applicable in all operational frequencies which can be fabricated by current CMOS technologies.

Advantages

- 35x quality factor improvement over phononic crystal CMOS resonant body transistors
- Low-phase noise oscillators eliminate the need for bulky Quartz crystals

Categories For This Invention:

Electronics & Circuits
Electronic Components
Materials
Micro & Nanotech
MEMS/NEMS (Materials)
Photonics
Other (Photonics)
Intellectual Property:

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Publications:

Phononic Crystals for Acoustic Confinement in CMOS-MEMS Resonators
IEEE Frequency Control Symposium (FCS 2014)
April 2014

Waveguide-Based Phononic Crystal Micro/Nanomechanical High- Q Resonators
Journal of Microelectromechanical Systems
April 3, 2012

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