CONTOUR-MODE PIEZOELECTRIC RESONATORS

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ABSTRACT

There is a growing demand in wireless communications for miniaturized, low-power, low-cost on-chip, high-Q resonators for use in front-end RF filters or as frequency references. This market need has spurred research into new vibrating micromechanical structures that can replace existing off-chip, bulky resonator technologies.

In pursuing this market need, researchers at UC Berkeley have developed a new-class of contour-mode, piezoelectric resonators. These micro-resonators exhibit high quality factors and small impedance values, and they can be fabricated using a post-CMOS compatible surface micro-machining process thereby offering an innovative solution for the development of RF communication systems.

In contrast to FBAR technology (that uses a thickness-mode), these contour-mode resonators permit the fabrication of arrays of micro-resonators with different frequencies on a single chip, and they can operate in air without significant performance degradation thereby reducing packaging costs. These resonators also enable a single chip to provide low motional resistance and high quality factor while spanning a MHz to GHz frequency range. Furthermore, these new devices have the potential capability to fine and coarse tune their center frequencies directly on-chip without the need of any extra post-processing step.

The Berkeley team fabricated these new resonators at low temperatures, and therefore they can potentially be integrated with state-of-the-art microelectronic components. These prototypes exhibited a frequency range of 20 MHz to 1.15 GHz and can potentially be extended up to 4 GHz. Certain designs exhibited quality factors of around 5,000 at 23 MHz with motional resistance of 100 ohms, and other designs exhibited quality factors as high as 2,900 at 473 MHz with motional resistance of 80 ohms.

APPLICATIONS

Micromechanical resonators for use as building blocks in wireless communications components such as filters and oscillators.

ADVANTAGES

Permits the fabrication of microresonators arrays with different frequencies on a single chip.

Can operate in air without significant performance losses thereby reducing packaging costs.

Enables a single chip to provide low motional resistance and high quality factor while spanning a MHz to GHz frequency range.

Potentially allows fine and coarse tuning of center frequencies directly on-chip without the need of any extra post-processing step.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	7,791,432	09/07/2010	2005-014
United States Of America	Issued Patent	7,492,241	02/17/2009	2005-014

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OTHER INFORMATION

KEYWORDS

wireless: component

CATEGORIZED AS

» **Communications**

» Wireless

RELATED CASES

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