Digitally Programmable Resonator by PZT-SOI Process

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Context

Co-integration of micro-mechanical systems (MEMS) with integrated electronic circuits (IC) has been attracting major attention in the development of the micromachining technology. In most IC systems, quartz oscillator is commonly used as a frequency reference to keep track of time and to provide a stable clock signal for digital circuits or stabilize frequencies for radio-frequency circuits.

Objectives

Here we aim to develop a piezo-MEMS oscillator array with more than 30 resonance modes that could be selectively excited by choosing an appropriate set of drive and pick-up electrodes distributed on the array network.

Methods

Stanley Electric Co., Ltd. in Japan has developed a piezo-technology compatible with the processing of ICs. PZT films of large piezoelectric constant have been developed on an SOI (silicon-on-insulator) wafer by using the Arc Discharged Reactive Ion-Plating [1].

Results

This more intricately developed resonator (Fig.2), in which 40 beams are coupled, deliver 31 resonant peaks in a frequency range from 10 kHz to 1 MHz. Q-factors are experimentally measured to be 600 or higher in air, and mechanical resonances obtained by laser Doppler vibrometer has also been confirmed by using the built-in piezoelectric sensors [2].

References