ORIGINS OF 1/F NOISE IN CRYSTAL OSCILLATORS

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In this contribution we shall investigate a possible origin and level of the, 1/f, noise of the fractional frequency fluctuations in crystal oscillators. It is well known that the 1/f or flicker noise is a universal phenomenon. Some investigators see its origin in the superposition of random walk noises with a given distribution of cut-off frequencies others in quantum phenomena, and some consider the problem unsolved. Here we shall investigate the sampled memory system as a possible source of the 1/f noise in crystal oscillators.

THE DEVELOPMENT OF NEW CONFIGURATIONS OF BAW COMPOSITE FILTER STRUCTURES

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Recent progress in perspective microwave filtering techniques for telecommunication systems based on the use of BAW resonator structures gives rise to detailed investigation of new possibilities and properties of such devices. This work is devoted to theoretical and experimental study of nontraditional configurations of multilayered stacked filtering structures including: - the analysis of possible combinations of Bragg and HBAR structures providing mode selection of high-Q resonances of HBARs; - various possibilities of the change in the degree of acoustical or electrical coupling between resonators composing filtering structures aimed at the formation of desirable shape of response of the filters; - properties and applications of multilayered structures made of dielectric and metallic films for acoustic isolation, electrical contacting and resonator protection from ambient influence; The theoretical analysis is based on the use of specially developed convenient 2 x 2 matrix approach that opens the possibility to connect electrical characteristics of the filter and mechanical properties of all the layers composing the structures. Experimental confirmation of the analytical conclusions was performed with ZnO and AlN piezoelectric films and different dielectric and metallic film multylayers used in microwave filters.
DESIGN AND OPTIMIZATION OF LOCALLY RESONATING SONIC CRYSTALS

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Sonic crystals containing locally resonant structures exhibit strong sound attenuation bands at frequencies about two orders of a magnitude smaller than those predicted by Bragg’s theory. Small-size slabs can be designed from these materials, which have sound attenuation effects similar to the usual sonic crystals, but in the audible frequency range.

Numerical simulations of the acoustic wave propagation in sonic crystals are performed within the framework of the Local Interaction Simulation Approach (LISA). By means of suitable imaging tools, they help to understand the underlying mechanisms. More importantly, they can be used for improving and custom tailoring their design and performance. For our simulations we have used a 13 cm slab of locally resonant sonic material and driven them at frequencies in the range from 0.3 to 6.0 kHz. Three different modes of local resonances are found in good qualitative agreement with experimental data, and their dependence on the structural parameters of the sonic crystal is analyzed. Based on these investigations we develop a simple analytical model, which is able to predict the resonance frequencies obtained by the experiments and LISA simulations.

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ELECTRONIC CONTROL METHOD FOR A RESONANCE FREQUENCY OF A PIEZOELECTRIC DEVICE USING GIC CIRCUIT

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Generally, it is difficult to realize the electrical control of a resonance frequency or a vibration mode of a piezoelectric device since the resonance frequency and the vibration mode are determined by both the dimensions and the material characteristics of the elements. On the contrary, the electrical control method of the resonance frequency of the piezoelectric device has been proposed. The electrical inductance is connected with the electrode of the non-driving piezoelectric so as to vary the resonance frequency. In the control method, the solid coil, that is a passive element, was employed and, hence, it is difficult to achieve the electronic control method of the piezoelectric device. In this report, the electronic control method of the resonance frequency of the piezoelectric element using GIC (generalized impedance converter) circuit was proposed. The GIC which
consists of two operational amplifier and five passive electric elements realizes the inductance without the solid coil. The GIC was applied to controlling the resonance frequency of the piezoelectric device. To realize the electronic control method of GIC, the voltage controlled element was required. The current-voltage characteristics between a drain and a source gate of a MOS-FET was employed as a voltage controlled register. Finally, the voltage controlled method for the resonance frequency of the PZT device using GIC was achieved.

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VASCULAR IMAGING
Chair: C. de Korte
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HIGH FREQUENCY HARMONIC IMAGING IN PRESENCE OF INTRAVASCULAR STENTS
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Background Tissue Harmonic Imaging (THI) has been shown to increase the image quality of ultrasound images in conventional echocardiography, due in large part to the reduced effects of phase aberration, reverberation and sidelobe artefacts. Feasibility studies showed the possibility to generate and image second harmonic signals at higher frequencies (20 MHz) with ultrasound biomicroscopy and Intravascular Ultrasound (IVUS) systems. An important application for IVUS is to image in the presence of reflective stents, which can degrade the image quality. Stents are small expandable wire mesh tubes that are inserted in a diseased coronary artery to keep it open. In this study we investigated potential benefits of THI relative to Fundamental Imaging (FI) at IVUS frequencies (20–40 MHz) in situations where a stent is located within the near field of the ultrasound beam.

Methods An experimental set-up was constructed to produce high frequency fundamental and harmonic imaging. Both fundamental and harmonic beam profile measurements of a spherically focused PVDF transducer (aperture 8 mm, focal length 13 mm) were performed. To examine the effects of a stent placed in the near field of a high frequency ultrasound beam, a flattened stent was interposed between the transducer and a 20 µm diameter glass point scatterer.