Utilization Features of the Mexanotron for Information Measurement Systems

Pidchenko S.K., Taranchuk A.A., Opolska A.E

Abstract – **problems of the theory, designing a piezoelectric resonator with the interelectrode backlash modulated under the influence of mechanical force and a mobile electrode in the form of membrane, named piezoresonance mehanotron are stated.[1]**

Key words - **piezoresonance mehanotron, sensor, interelectrode backlash.**

INTRODUCTION

Accent of development of modern precision radio electronics is constant growth of high accuracy devices amount. Dominating role among them belongs to piezoelectric devices (PD). They are widely adopted in communication equipment, frequency stabilizing systems and carrier transformation systems (amplitude, frequency and phase transducers, filters, detectors). One of the most perspective areas is application of quartz crystal resonators and piezoelectric oscillating systems in precision information-measuring systems as highly sensitive elements which have frequency output, high accuracy and universality. Problems of the theory and designing of piezoresonance mehanotron (PRMT) constructed on the basis of piezoelectric resonator with the interelectrode backlash (IEB) modulated under the influence of mechanical force and a mobile electrode in the form of membrane are stated. Resolution capability of PRMT for pressure measuring is 0.03…0.05 mm. Hg. This is considerably better than characteristics of prime semi conducting devices [1, 2, 3]. The particular PRMT is advised to be used in high-accuracy informative medical channels and systems of human hemodynamic parameters [4, 5]. Introduced PRMT is related to measuring converters with control of its resonance frequency by changing magnitude of backlash between launch electrodes of piezoelectric element (PE). Constructive association of such converters with the elements transforming external action of the various physical nature in moving, enables to synthesize sensors of pressure, effort, acceleration and other measuring converters. Modulated backlash application, i.e. measuring capacitor C_0 (Fig. 1) inclusion inwards construction enables to increase the capacitive-ratio, and therefore tuning range of oscillating system. For example, on frequency of 10 MHz at modulation of a backlash it is possible to receive frequency deviation of (25 … 30 kHz).

Following descriptions are made: L_1, R_1, C_1 - dynamic equivalent parameters of piezoelectric element (PE) on the fundamental mode of the thickness-shear vibrations; C_{pe} - PE static capacity; $C_1 / C_{pe} = m$ - capacitive ratio (for AT-cut crystal $m = (4...7) \cdot 10^{-3}$); $C_0 = C_m + C_{par}$ - capacitive parasitics with mounting capacity.

Pidchenko S.K., Taranchuk A.A., Opolska A.E – Khmelnitsky National University, 11, Instytutska St., Khmelnitsky, 29016, UKRAINE, sergpchn@ya.ru, allatr@ukr.net, anitopol@mail.ru

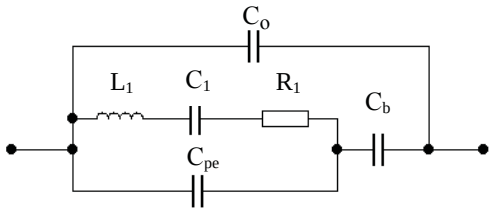

Fig. 1. Measuring converter with IEB equivalent electric circuit

For typical values of parameters of the quartz resonator the control characteristic of PRMT is constructed. Two operating modes PRMT are considered: "linear" and "nonlinear". At work of PRMT in a "nonlinear" mode it is possible to achieve the maximum resolution capability (this mode is recommended to be used in pressure sensors). Linear mode enables to achieve maximum linearity of modulation characteristic at demodulation of a measuring signal by the linear frequency detector [5].

Comparison of two types of operating modes: PRMT with modulated IEB and using of external capacitive control where sensitive capacitive element is used as a sensor has shown multiple advantage of PRMT on a transducing steepness and preferability of its use.

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