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СОВРЕМЕННЫЕ ПРОБЛЕМЫ РАДИОТЕХНИКИ И ТЕЛЕКОММУНИКАЦИЙ

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THE TRANSDUCER OF PRESSURE WITH THE FREQUENCY OUTPUT

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Abstract — In the given article the possibility of making the transducer of pressure with a frequency output signal is shown on the basis of the autogenerating arrangement which will consist of bipolar transistor and MOSFET transistor. Analytical dependencies of function transformation and sensitivity are received. Sensitivity of the arrangement $(2,0...4,25) \text{ kHz/Pa} \cdot 10^5$.

1. Introduction

The microelectronic transducers of mechanical quantities define precision and reliability of monitoring systems of processes, environmental properties, safety of operation of nuclear, thermal, chemical installations, aircrafts, sea objects, etc.

One of perspective scientific direction, allowing to solve a complex of the tasks in view suggested in the given operation, is using of dependence of jet properties and a negative resistance of semiconductor devices on effect of pressure and making on this basis of a new class of the microelectronic transducers [1]. In devices of such type there is a transformation of pressure to the frequency signal that allows to establish transducers on integrated technology and enables to boost fast operation, precision and sensitivity, to improve reliability, noise performance in terms of error probability and long-term parameter stability [2].

2. The main part

The circuit of the frequency transducer of pressure is presented on fig. 1. The transistor structure of the frequency transducer of pressure contains bipolar and MOSFET — transistors, and the emitter bipolar to the transistor connected to sink MOSFET — transistor. A tensiosensitive element is the bipolar transistor.

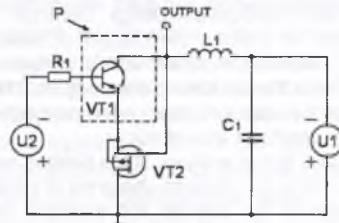


Fig. 1

The generator of electrical oscillations is created on the basis of transistors structure with a negative resistance. Presence of a differential negative resistance speaks necessity to cancel to them of an energy loss in an oscillation circuit created reactive component impedance on electrodes a collector-sink and an exterior inductive resistance. One of basic characteristics of the transducer is dependence on transformation. Function of transformation is featured by the equation

$$F = \frac{1}{2\pi |R_g^{(-)}(P)| C_{EKV}(P)} \left[\frac{R_g^2(P) C_{EKV}(P)}{L} - 1 \right]^{1/2}, \quad (1)$$

where $R_g^{(-)}(P)$ — is a dynamic negative resistance of an oscillation circuit; $C_{EKV}(P)$ — is the equivalent capacity of a oscillation circuit of the transducer; L — is a tuned-circuit inductance. Sensitivity of the transducer is defined on the basis of expression (1) behind the formula

$$S_F^P = \frac{R_g(P) C_{EKV}(P) \frac{dR_g(P)}{dP} + R_g^2(P) \frac{dC_{EKV}(P)}{dP}}{4\pi R_g(P) C_{EKV}(P) \sqrt{\frac{R_g^2(P) C_{EKV}(P)}{L} - 1}} - \frac{\sqrt{\frac{R_g^2(P) C_{EKV}(P)}{L} - 1} \frac{dR_g(P)}{dP}}{2\pi R_g^2(P) C_{EKV}(P)} - \frac{\sqrt{\frac{R_g^2(P) C_{EKV}(P)}{L} - 1} \frac{dC_{EKV}(P)}{dP}}{2\pi R_g(P) C_{EKV}^2(P)}$$

The diagram of function of transformation is presented on fig. 2, and the diagram of sensitivity is on fig. 3. Apparently from this diagram, sensitivity of the transducer changes from $4,25 \text{ kHz/Pa} \cdot 10^5$ up to $2,0 \text{ kHz/Pa} \cdot 10^5$ over the range from 0 up to $12 \cdot 10^5 \text{ Pa}$.

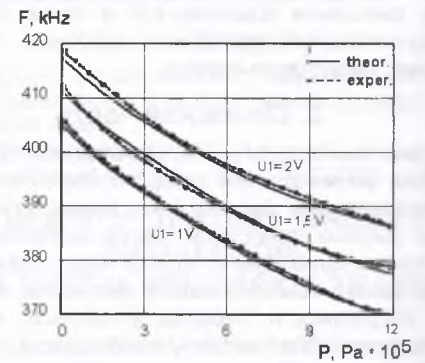


Fig. 2

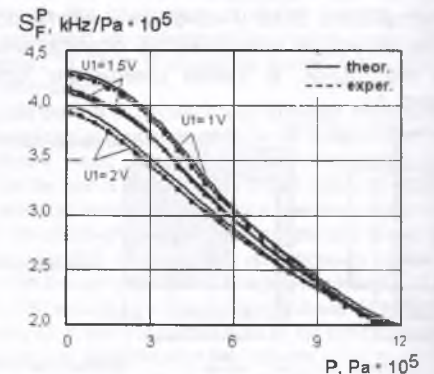


Fig. 3

3. Conclusion

The integrated circuit of the transducer of pressure with the frequency output is offered on the basis of bipolar and field transistors in which as tensiosensitive element the bipolar tensiotransistor on a membrane and MOSFET transistor. Sensitivity of the transducer of pressure makes $(2,0...4,25) \text{ kHz/Pa} \cdot 10^5$ over the range pressures from 0 up to $12 \cdot 10^5 \text{ Pa}$.

4. References

- [1] Осадчук В.С. Реактивные свойства транзисторов и транзисторных схем / В.С. Осадчук, О.В. Осадчук. — Винница: Универсум-Винница, 1999. — 275 с.
- [2] Новицкий П.В. Цифровые приборы с частотными датчиками / П.В. Новицкий, В.Г. Кноринг, В.С. Гутников. — Энергия, 1970. — 424 с.