МІНІСТЕРСТВО ОСВІТИ І НАУКИ

ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ

ІНСТИТУТ АВТОМАТИКИ, ЕЛЕКТРОНІКИ ТА КОМП'ЮТЕРНИХ СИСТЕМ УПРАВЛІННЯ

MEASUREMENT, CONTROL AND DIAGNOSIS IN TECHNICAL SYSTEMS

ДРУГА МІЖНАРОДНА НАУКОВА КОНФЕРЕНЦІЯ

«ВИМІРЮВАННЯ, КОНТРОЛЬ ТА ДІАГНОСТИКА В ТЕХНІЧНИХ СИСТЕМАХ (ВКДТС -2013)»

Збірник тез доповідей

29-30 жовтня 2013 р.

ВНТУ
ВІННИЦЯ
2013

УДК 621.3.08
ББК 30.607

Друкується за рішенням Вченої ради Вінницького національного технічного університету Міністерства освіти і науки

Головний редактор: **В.В.Грабко**

Відповідальний за випуск: **Кучерук В.Ю.**

Рецензенти: **Столярчук П.Г.**, доктор технічних наук, професор
Кухарчук В.В., доктор технічних наук, професор

Друга міжнародна наукова конференція «Вимірювання, контроль та діагностика в технічних системах» (ВКДТС -2013), 29-30 жовтня, 2013 р. Збірник тез доповідей. – Вінниця: ПП «ТД«Едельвейс і К», 2013. – 288 с.

ISBN 978-966-2462-35-7

У збірнику опубліковано матеріали конференції, присвяченої проблемам теоретичних основ вимірювань, контролю та технічної діагностики, інформаційно-вимірювальних технологій та метрології.

УДК 621.3.08
ББК 30.607

ISBN 978-966-2462-35-7

UDC 621.382

V.Y. Kucheruk, Dr.Tech.Sci., Prof.; K.V. Ovchynnykov, assistant; M. D. Molchaniuk, student

THE USAGE OF THE LINEAR INTERPOLATING FILTER FOR AN ACCURATE FLUCTUATION FADING TIME MEASURING ACTIVATED IN LC-CIRCUIT

Keywords: LC-circuit, linear interpolation filter, time measurement.

On the modern stage of measuring technique development, receipt of measuring information is necessarily accompanied by an analog-to-digital conversion. Despite that not only a voltage can be an analog value, today an analog-to-digital conversion is being understood exactly as a conversion of voltage into a digital code. The accuracy of conversion depends on the resolution of the analog-to-digital converter that is why the basic method of rise the accuracy of conversion is the increase of number of bits.

As an alternative of voltage conversion into a digital code there are the high-precision analog-to-digital converters built on the principle of converting into the code of time intervals duration [1]. Such converters provide the measuring of time intervals with the accuracy of order of 22 - 250 ps, that is equivalent to voltage conversion in a digital code with a number of bits of 30, and the increase of resolution in such converter is limited only by the measuring time.

It is suggested to apply such analog-to-digital converter at measuring of dielectric coverings thickness of metallic surfaces for determination of transient process duration activated in the oscillatory circuit of primary measuring converter [2].

Duration of transient process (fading time of the excited vibrations t_f) in an oscillatory circuit is determined as a time for which amplitude of free vibrations will diminish in times. So for determination of transient process duration it is necessary to assign envelope curve of a signal and compare the amplitude value of envelope curve with exemplary voltage U_0/e, where U_0 is maximal voltage in a circuit (fig. 1). The selection of envelope curve of such signal is not a trivial task because the application of the known methods does not provide the necessary accuracy of recreation, and a measuring error grows accordingly.

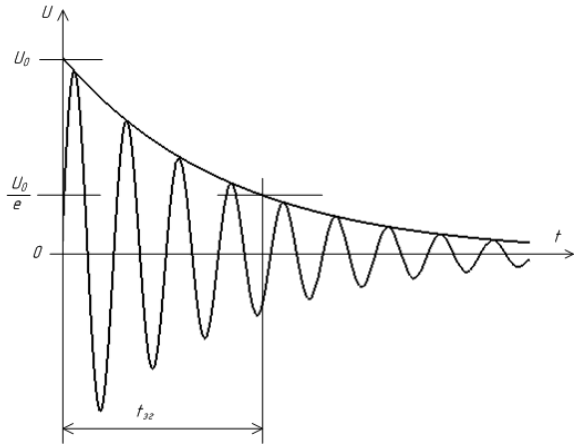

Fig.1. The determination of transient process duration

And as a change of transient process duration is substantially larger than the period of vibrations, and accordingly larger than the area of "ideal" recreation of AB (fig. 2), so such approach does not allow to provide the minimum error of recreation on all range of measuring [3].

For expansion of the "ideal" recreation area it is suggested to use the detector with the linear interpolating filter described in [4]. The basic idea of precise recreation of the envelope curve is the application of the linear interpolation on the local maximums of harmonious signal. The functional circuit which explains the work of the detector with the linear-interpolating filter is given on fig. 3.

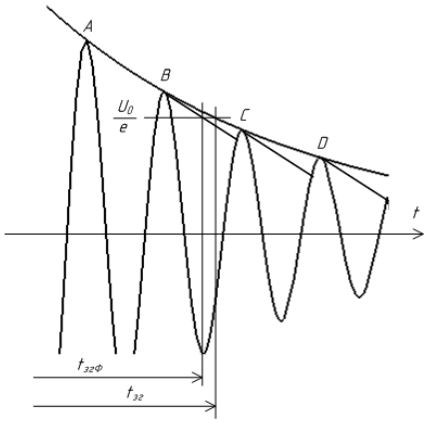

Fig.3. The functional circuit of the detector with the linear interpolation filter

Applications of the simplest low pass filters circuits do not give satisfactory results as the envelope curve has a complicated form which is far from harmonious one with a wide spectrum which does not allow to reproduce a modulating signal by the simplest methods [5].

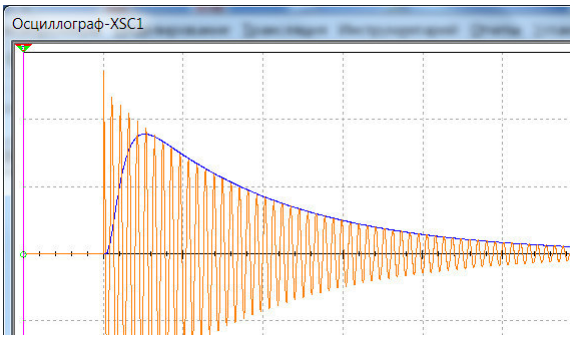

Fig.5. The result of linear interpolation filter work

Application of more difficult schemes, for example a peak detector provides a signal recreation close to the ideal only in the certain area of AB (fig. 2), as far as nominal values of circuit driving elements remain permanent.

The results of the circuit work are given on fig. 5. On the oscilloscope screen the signals from an oscillatory LCcircuit output, and from the linear interpolating filter output and control circuit output are represented.

REFERENCES

1. http://www.acam.de/products/time-to-digital-converters/tdc-gp1

2. Shabatura U.V. Research of measuring converters of metallic surfaces dielectric coverings thickness with time presentation of information. The National University Bulletin “Lvivska Politekhnika”: Automation, measuring and management. - №551. – L.2006. – p.63-69

3. Kartsev E., Chulkov E. Stereodecoder with a Quartz Resonator. Radio. 1986, №2, p.38-42

4. Pat.2365910 Russian Federation, MPK G01N27/90. The Vortexcurrent Control Method and Device for its Realization/ Kibrik G.E., Naldaev N.D.; a declarant and a patent holder. Limited Liability Company. Scientific and Production Enterprise “TIK” (LLC SPE “TIK”). - 2007103265/28; declarated 26.01.2007; published 27.08.2009. – 3 p.: illustr.

5. Semiconductor circuit technology: Reference Guide. Transl. from German. – M.: Mir, 1982. – 512 p. with illustr.

6. PRZEGLĄD ELEKTROTECHNICZNY, ISSN 0033-2097, R. 89 NR 8/2013. – p.68-70.