Method of Primary Signal Normalization for Digital Sensor Platform

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Abstract - **It is described a way of compensation the absence of normalizing the signal by an analogue means before transformation this signal to a digital code.**

Keywords – **Signal normalization, Automatic gain control, Digital sensor.**

I. INTRODUCTION

Emersion of the analog-to-digital converter with the integrated amplifiers allows to convert primary signals to a digital code without using of analogue processing circuits. And actually the same means also possesses the digital sensor platform [1] where its task is to record the cardiovascular system biosignals. Measurements are made by indirect method in temporal means of determination of time constants of relaxation processes. But due to specificity of these signals (value of a constant component is equal 97 - 99.7 % from all signal level, presence of high-frequency noise) the number of quantization levels on a desired signal in a digital code is very small, it make worse the resolving capacity.

II. PROBLEM SOLVING

As measurements are made in time-domain, the digital values of a primary signal is catching in the counter/timer. The more the clock rate of a digital device (MCU, CPLD), the better common resolution capability of measurement and more quickly the counter/timer can attain overflow. At work on energy storage of a signal actual amplification depends on an acquisition interval and can be controlled [2]. Therefore, selecting by the instrumentality of an automatic gain control (AGC) necessary time constant of relaxation process can be achieved by necessary resolution capability.

On fig. 1 it is shown dependence of resolution capability on a desired signal from a acquisition interval of a primary signal at different clock rates of a digital device. And on the axis of ordinates the time-domain is divided into parts, equal to the maximum value of the counter. The range of values of a time on the axis of abscissas is restricted from above to the period of a sampling period (in our case 0.01 s). From the figure follows, that it is possible to select time constant of relaxation process in such a way that a signal, on the one hand, had a maximum number of quantization levels on a desired signal (due to decrease of a constant component), and on the other hand, it would not be distorted by discontinuity of the first kind at overflow of the measuring counter.

The increasing of an acquisition interval of energy storage allows to increase the number of quantization levels on a desired signal, approximately in 10 times at a clock rate in 8 MHz (case A). But, apparently from fig. 1, for a clock rate in 20 MHz, (case B) still remains a sizeable reserve of a time for a possibility to storage the signal's energy. Therefore it is possible to continue detection to following normalization on the maximum value of the register (case D). Because of overflow of the register of the measuring counter/timer, resolution capability will be magnified in relation to case B in 2 times.

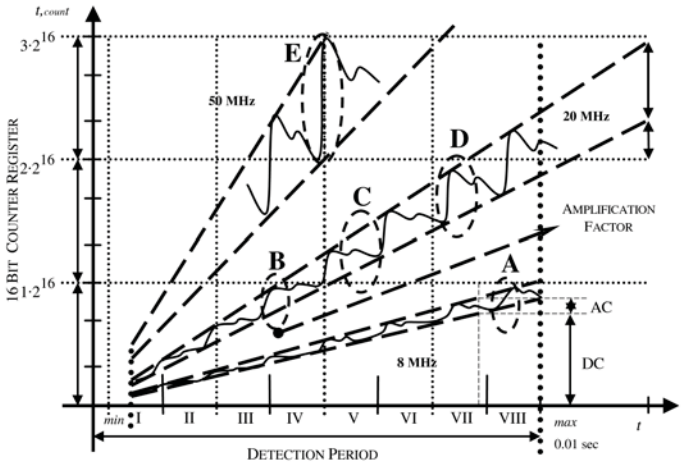

Fig.1 Digital normalization nomogram.

Interesting also a case with C because there is achieved a suppression of dc component of the signal. And probably in such a way it can be possible to get rid of necessities in digital filtration.

If to allow numerous overflows of the register of the measuring counter/timer, as in case of E, it's possibly to achieve result when all quantization levels 16-bit counter will fall to a desired signal.

III. CONCLUSION

The Way of normalizing of a digital primary signal on the basis of signal's acquisition interval regulation and criterion level maintenance of signal relatively to overflow of the measuring counter, allows compensating absence of analogue normalizing circuits in the digital sensory platform.

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