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DEVELOPMENT OF A DEVICE FOR AUTOMATIC GAIN SELECTION OF A MEASURING AMPLIFIER USING A FOLLOWING TYPE ANALOGUE-DIGITAL CONVERTER

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ABSTRACT

The article discusses the increase in the efficiency of the device for automatic selection of the gain of the measuring amplifier using an analog-to-digital converter of the servo type. A block diagram of the developed analog-to-digital converter of the tracking type is presented, which, by its principle of operation and complexity, is an order of magnitude simpler than the others.

Keywords: analog-to-digital converter, signal error, gain, measuring amplifier.

INTRODUCTION

The intensive development of microprocessor technology has led to the creation of high-performance personal computers that make it possible to realize the significant potential of digital processing of analog information. To interface a personal computer with the objects of study, data collection devices are used, the signals at the inputs of which can in many cases change in a wide (80 dB or more) dynamic range; analysis, equipment for seismic research, equipment used for nuclear experiments, etc. Taking into account the requirements for the dynamic range of the input signals of information converters leads to the development of special data acquisition devices with an extended range.

Let's consider the main methods of building data collection devices with an extended range Fig.1.

One of the ways to increase the dynamic range is to use a tracking type analog-to-digital converter, which, by its principle of operation and complexity, is an order of magnitude simpler than the others.

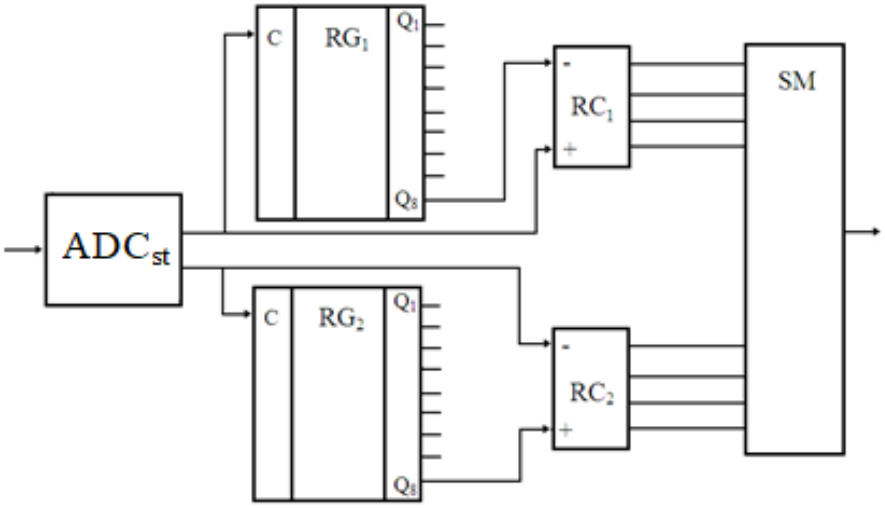

Fig. 1. Structural diagram of the differentiator:
RC1, RC2 - reversible counters; SM - totalizer

The properties of representativeness, constructibility and universality can be provided and reflected in the form of an efficiency criterion in an explicit form. However, from the point of view of the simplicity of the criterion, it is desirable that the minimum number of parameters appear in it. In addition, with a large number of parameters taken into account, it is difficult to construct criteria that have the property of concreteness, i.e. having a clear physical meaning. In connection with the foregoing, it is advisable to identify the minimum set of external parameters that must and is sufficient to be taken into account when constructing the efficiency criteria for an analog-to-digital converter of the servo type [1, p. 448]. When solving this problem, we will distinguish between functional and cost external parameters. Next, we determine which parameters from the functional group can be dominant, therefore, explicitly included in the ADC efficiency criteria. Reliability can be considered in relation to catastrophic and gradual (degradative) failures. Gradual failures are associated with drifts in the characteristics of the converter, aging of its elements, etc. They do not affect the performance of the ADC, but only affect its accuracy. Therefore, if permanent failures are taken into account when assessing the accuracy of the converter, then reliability should be considered only in relation to catastrophic failures [1, p. 217].

When building an ADC at a certain level of development of circuitry and technology, the reliability of the device, taking into account the use of the same elements, the complexity is determined by a directly proportional value of the cost, that is, based on these considerations, we can accept the cost criterion - in the form of a partial reflection of the reliability and complexity of the designed ADC. It should also be taken into account that the analog-to-digital converter of the servo type is not produced in the industry in a block version. The author has developed an analog-to-digital converter of the servo type, the circuit of which is shown in fig. 2.

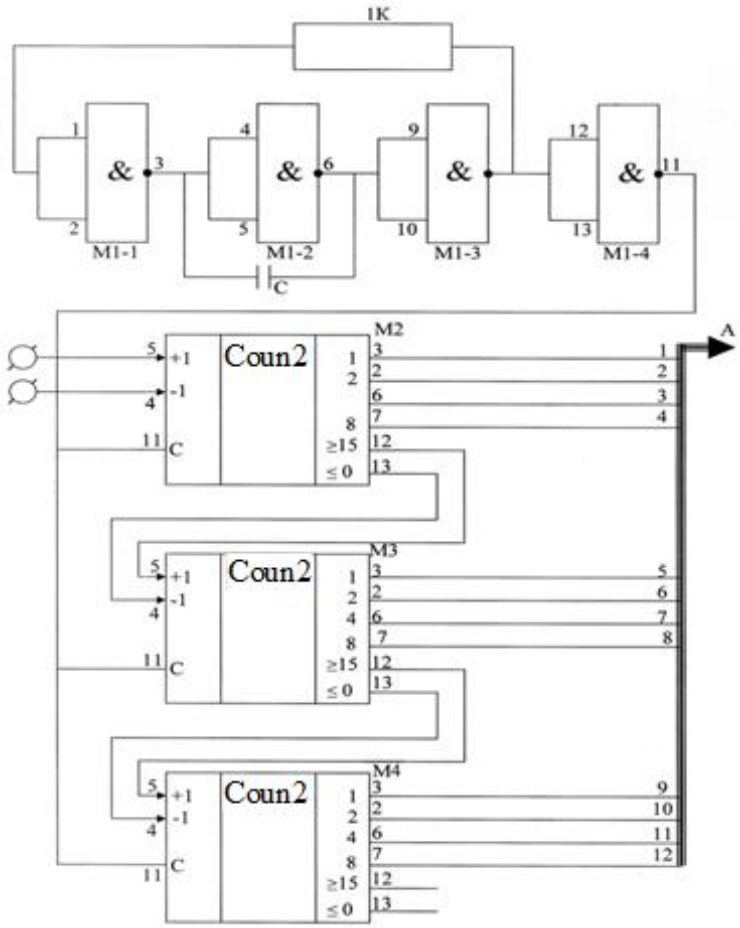

Fig. 2. Schematic diagram of the analog-to-digital converter of the servo type

In this scheme, the clock frequency is provided by a pulse generator assembled on the basis of the K155LA3 chip marked in Fig. M1, according to the ring scheme [2, p.186]. The clock frequency from the generator output is fed to the input from a reversible twelve-digit counter, made on the basis of K155IE7 series microcircuits, marked in the figure with M2, M3 and M4 microcircuits. The chips themselves are four-bit. The assembled microcircuits ensure the operation of a twelve-bit reversible counter [3, p.376]. A twelve-bit code is fed to the input of a twelve-bit digital-to-analogue converter made on the basis of the K572PA2A microcircuit. The output signal of the digital-to-analog converter is reproduced in the form of a current. To convert the output signal into a potential value, we use the 140UD7 microcircuit, in the current-voltage converter mode [4,5]. The output signal from the microcircuit is fed to the outputs of comparators based on the K554CA3A microcircuit, the output signals of the comparators are converted in the 0V and + 5V mode using resistive-diode circuits. These signals are connected to the information inputs "+1" and "-1" of the reverse counter. Thanks to feedback, the digital code at the output of the reversible counter at any time will correspond to the values of the analog signal at the input of the developed analog-to-digital converter of the tracking type [6].

REFERENCES

1. Уолт Кестер. Аналого-цифровое преобразование: – М.:Техносфера, 2007. - 1016 с.
2. Юэн Ч., Бичем К., Робинсон Дж. Микропроцессорные системы и их применение при обработке сигналов. - 2-е изд., перераб. и доп. – М.: Радио и связь, 1994. - 280 с.
3. Титце У., Шенк К. Полупроводниковая схемотехника, 12-е изд. Том I: Пер. с нем. – М:ДМК Пресс, 2008.- 832 с.: ил.
4. Волович Г.И. Схемотехника аналоговых и аналого-цифровых устройств, 4-е изд. – М:ДМК Пресс, 2017.- 636 с.: ил.
1. Абидова Г.Ш. Анализ и выбор типа аналого-цифрового преобразователя используемого при обработке данных на выходе физико-химических анализаторов // Сборник статей Международной научно-практической конференции «Технические и технологические основы инновационного развития», г. Саратов, 2019 г., с. 3-4.
2. Абидова Г.Ш. Разработка средств автоматизации обработки данных на выходе адсорбционной установки // Международная научно-практическая конференция «Вопросы методологии естествознания и технических наук: современный контекст», г. Белгород, 2019 г. стр. 94-97.