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Modeling the Method of Linear Approximation of Signals in SPLC (Sensor Programmable Logic Controller)

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Annotation

This paper presents a model of signal approximation using Matlab software. The following design recommendations have been developed for the module to work accurately and correctly. The sensor software program logic controller (PLC) uses a schematic diagram of the differential filter. In evaluating this filter, FDM (Frequency Division Multiplexing) is a technology of multiplexing method that involves combining multiple signals through a common medium.

Key words: sensor, program, module, logic, microchip, temperature, connection, block, circuit, signal, termjuft, contact, approximation, design, mathematics, frequency

1. Introduction

If the cold joint is in a very stable environment, periodic measurements of the cold joint will suffice. To account for the cold connection, the external temperature sensor reading must first be converted to temperature (using ADC (analog digital converter) 1220) based on the device's transfer function. The schematic block diagram of the software written on the microchip is shown in Figure 1.

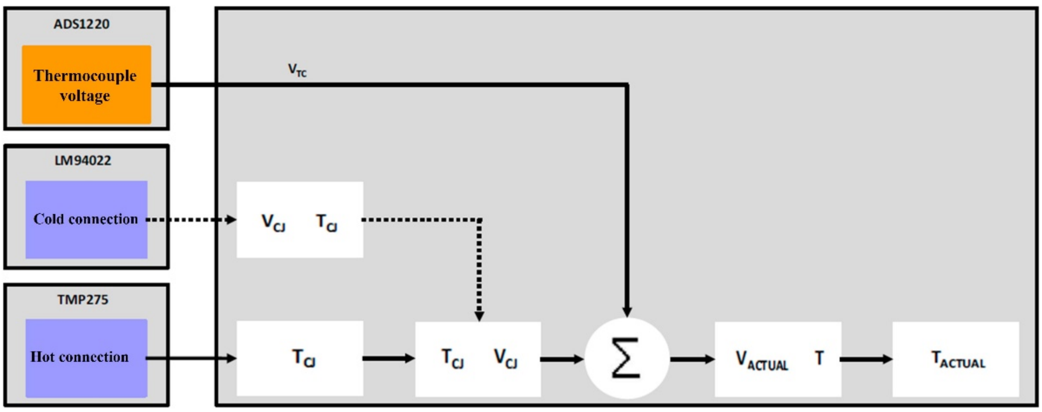

Figure 1. Signal approximation software block diagram

The signals coming from the thermocouple, cold connection and hot connection are processed in the PLC (programmable logic controller) and linearly approximated. In the design of the PLC, the necessary design work was carried out to connect any type of thermocouples.The calculation process based on the signals coming from the thermocouple, cold connection, and hot connection is performed in the PLC. As shown in Figure 1, the signals in the thermocouple, cold, and hot connections are connected as shown in

$V_{CJ} + V_{TC} = V_{ACTUAL}$ (1)

The potential difference across the thermocouple contacts V_{TC}The signal coming from the cold connection is followed by the operation in expressionV_{CJ} (1). The signal on the hot connection is compared to V_{ACTUAL}.The T_{ACTUAL} value is formed based on the V_{ACTUAL} results. Approximation of Signals and T_{ACTUAL} values modeled

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with the help of Matlab software can be seen in Figure 2.To perform linear interpolation using a table, the measured thermocouple voltage values are first compared with the values given in the table column until the value of the table exceeds the value of the rotating measurement.

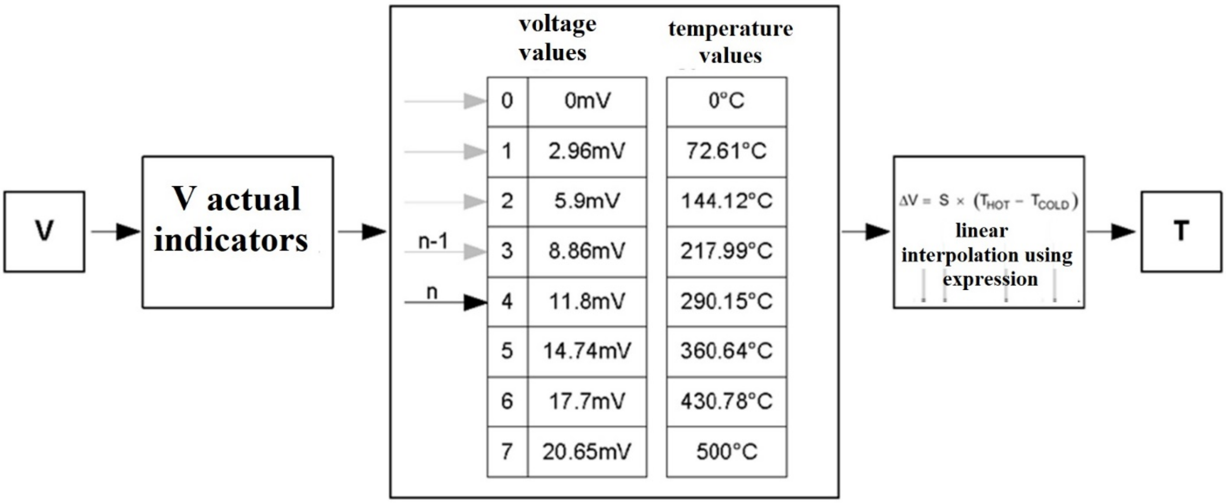

Figure 2. Signaling approximation model using Matlab software

Analysis and results

The model shown in Figure 2 can be written mathematically as follows.

$$T = T_{LT}[n-1] + (T_{LT}[n] - T_{LT}[n-1])\left(\frac{V_{in} - V_{LT}[n-1]}{T_{LT}[n] - T_{LT}[n-1]}\right) \quad (2)$$

$$T = V_{LT}[n-1] + (V_{LT}[n] - V_{LT}[n-1])\left(\frac{T_{in} - T_{LT}[n-1]}{T_{LT}[n] - T_{LT}[n-1]}\right) \quad (3)$$

T-output temperature values;

V-input voltage values;

T_{LT} -specific temperature values;

V_{LT} -specific voltage values.

The thermocouple module (SPLC) performs the mathematical operations shown in (2) and (3) based on the potential difference from the thermocouple rods, the cold connection, and the hot connection data.Performs linear approximation of the resulting values. The following design recommendations have been developed to make the module work accurately and correctly:

1. An isothermal block is placed between the cold connection and the module (to obtain accurate values of temperature from external influences and the cold connection).

2. Thermocouple connections must also fall into the isothermal block.

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3. Thermocouple rods should be located at a distance from high voltage currents.
4. The hot connection sensor must be located inside the isothermal block.
5. The hot connection temperature sensor must be placed on the side where the thermocouple contact is located.
6. The isothermal block should be located away from heat sources.
8. For optimal system operation, the module and hardware must be stored in a thermally stable environment.
9. Sensors in hot and cold connection must have a minimum volume.

As a result, the design of the SPLC module will look like the following.

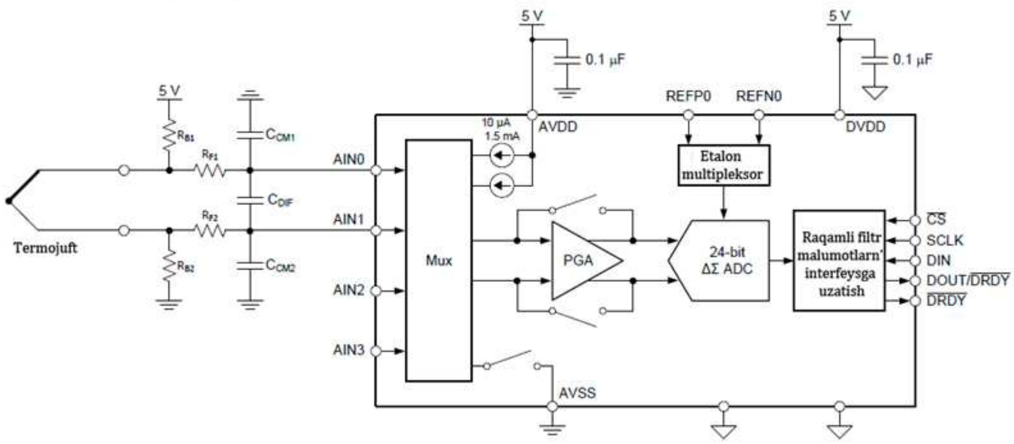

Figure 3. General schematic diagram of SPLC

The design of the device and the development of the chip was carried out using Matlab software. An overview of the chip can be seen in Figure 3.

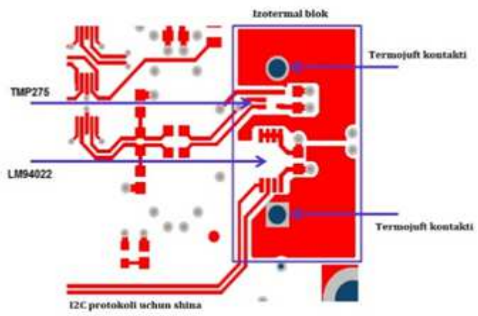

Figure 4. SPLC module chip view

Outcome analysis

Evaluate filters in the PLC chip

External influences must be taken into account when designing the device.PGA (pin-grid array is the standard for electronic packaging used in most second- and fifth-generation processors) and other microchips alone are not sufficient to protect signals from external interference.Thermocouple output signals are in the millivolt range, and noise at any frequency can easily affect it. If the high frequency noise exceeds the PGA allowable value, the

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signals will start to change.The ADS1220 has an internal digital FIR (Finite Impulse Response) filter that eliminates 50 Gts or 60 Gts of noise interference or controls both at 5 and 20 SPS (Symbolic Programming System) transmission speeds at the same time can be set to.In the ADC1220, the input signal is selected using a modulator, not at the output data rate. However, any frequency components that have an input signal as a modulator frequency are not attenuated and converted to another form (unless attenuated using an external analog filter). Some signals are broadband. For example, the change in signal output from a thermocouple is 1 Hz.However, long thermocouple rods can easily sense high frequency noise. Therefore, it is generally recommended that the ADC introduce a low-frequency, anti-deviation RC filter to the input contacts. This system minimizes the effects of high frequency interference. However, the filter resistance must not exceed 1 Hz.When an excessive resistance is applied to the filter, this resistance begins to interact with the input impedance of the ADC, resulting in an error. The thermocouple sensor is differentially connected to the high input impedance of the ADC via a simple low frequency filter on different input lines.When an excessive resistance is applied to the filter, this resistance begins to interact with the input impedance of the ADC, resulting in an error. The thermocouple sensor is differentially connected to the high input impedance of the ADC via a simple low frequency filter on different input lines.

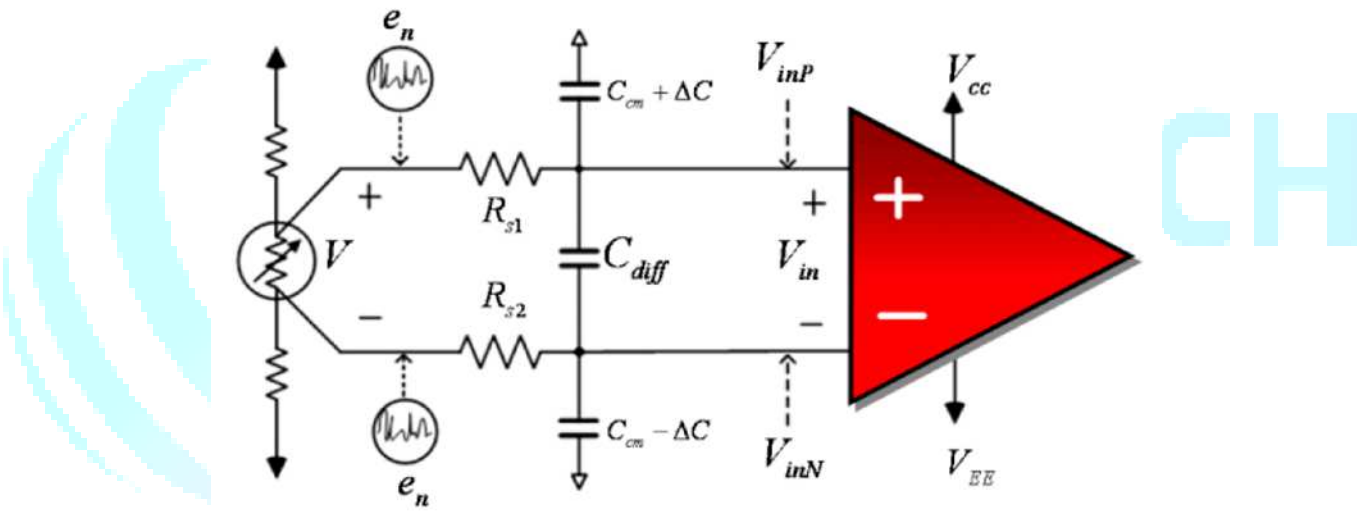

Figure 5. Schematic diagram of the differential filter used in PLC

In evaluating this filter, FDM (Frequency Division Multiplexing is a multiplexing method that means combining multiple signals through a common medium.)Technology was used. In FDM, signals of different frequencies are combined for simultaneous transmission.In FDM, the total bandwidth is divided into inconsistent frequency bands. Each of these ranges is a different signal carrier that is generated and modulated by one of the transmitting devices. Frequency ranges are used to prevent signals from interfering with each other.The modulated signals are combined using a multiplexer (MUX) at the sending end. The combined signal is transmitted over the communication channel and at the same time allows the transmission of several independent data streams at the same time. At the end of reception, individual signals are output from the combined signal using demultiplexing (DEMUX).

The calculation of FDM in PLC was performed using the following expression.

$$F_{DM} = \frac{1}{2\pi(R47+R45)\left[C65+\left(\frac{C68\cdot C61}{C68+C61}\right)\right]} \quad (4)$$

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As a result

$$F_{DM} = \frac{1}{2\pi(499\ \Omega + 499\Omega)\left[1\ \mu F + \left(\frac{0.1\ \mu F\ \cdot 0.1\ \mu F}{0.1\ \mu F + 0.1\ \mu F}\right)\right]} \approx 152\ Hz$$

This means that the modulated signals coming out of the filter are output in the frequency range of 152 Hz (External input filter network width). The signals in this range are a sufficient value for signal reception for the ADC1220 microchip.

Conclusion

1. A model of signal approximation using Matlab software has been developed.
2. Design recommendations have been developed to perform linear approximation of the resulting values.
3. In the PLC chip, a schematic diagram of the evaluation of the filter in the differential form using the PLC has been developed.

The modulated signals coming out of the filter are in the frequency range of 152 Hz (External input filter network bandwidth) and it is shown that the signal reception value is sufficient for the ADC 1220 microchip.

References

1. Tarasov V.B., Svetkina M.N. Intellectual SCADA systems. Science and education. E.j. №FS 77.2009.
2. Andreev E.B., Kutsevich N.A., Sinenko O.B. SCADA systems. Science and education. E.j..2004.
3. Karimov A. I., Ismanov M.Mathematical Modeling of Heat Flux Distribution in Raw Cotton Stored in Bunt. *Engineering* Vol.12 No.8, August 20, 2020,591-599.DOI: 10.4236/eng.2020.128041.
4. Karimov A. I., Muradov R., Jabborov A., Ismanov M.A. Measurement of density, compressive strength and mass of raw cotton stored in the bun. Patent. № DGU 20211237. For EXM software.20.04.2021.
5. Ismanov M., Mardonov B. and Tadaeva Y. (2014) Experimental and Theoretical Studies ofVibrational Motion of Raw Cotton on Inclined Mesh Surface.International Journal ofInnovation and Scientific Research, 9, 78-85.
6. Ismanov M., Karimov A. (2020) Mathematical Modeling of the Technological ProcessesOriginal Processing of Cotton. International J. of Innovation and Applied Studies, 1, 28-39
7. R.Muradov, F.Rakhimov, H.Kasymov, A.Karimov "Theoretical Study Of The Movement Of New Impurities And Heavy Impurities" The American journal of engineering and technology, *Volume02 Issue07 July 2020. DOI: -10.37547/tajet.*ISSN (e): 2689-0984 DOI: https://doi.org/10.37547/tajet/Volume02Issue07-03
8. R. Muradov, A. Makhkamov, and S. Khusanov "Separation of Cotton Crops and Foreign Substances in the Air Flow from the Centrifugal Force" Journal of the Science and Technology Development Science and Technology Journal of Bukhara Institute of Technology.
9. M. Abduvohidov, A. Pirnazarov, S. Khusanov and B. Abdusattarov "Issuance of peace in the world on gesture parameters." International confrence "Science and practice: anew level of integration in the modern world" Confrence proceedings Berlin 2018.