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APV Receiver In Automated Systems

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ABSTRACT

Optoelectronic sensors based on anomalous photo-voltage (APV) curtains derived from semiconductor compounds are attracting the attention of many experts today. The use of APV receiver as the first converter in automated systems allows to increase the efficiency of a number of parameters of the system, such as energy saving, reliability, speed, accuracy.

KEYWORDS

APV, sensor, photosensitive, spectrum, mathematical model, light, autonomous, frequency, sensors-sound power, photochemical.

INTRODUCTION

Regardless of the type of sensors, the following basic technical requirements are imposed on them: accuracy, sensitivity, fastness, reliability, dimensions, weight. Conditionally, the sensors can be considered consisting of receiving, intermediate and executive parts. The receiving part is affected by the change in the amount of input X, changing it to some intermediate amount. This amount is compared with the etalon (sample) value of a similar physical quantity. Then the output y signal is formed by influencing this sensor to the executive part. Depending on the physical composition of the input X quantity, they allocate electrical, thermal, mechanical, optical, acoustic, liquid and gas sensors. Electric sensors–current, voltage, power, frequency, magnetic current; thermal sensors-temperature and amount of heat; mechanical sensors-power, pressure, wiper, speed, acceleration; optical sensors-light power, illumination; acoustic sensors-sound power, its frequency, power; liquid and gas sensors-measure pressure and speed. Each type of sensors, in turn, are also classified according to the principle of operation of the receiving part, that is, they are divided into groups. For example, optical sensors are divided into photoelectric, photochemical, photothermic and photomechanical groups.

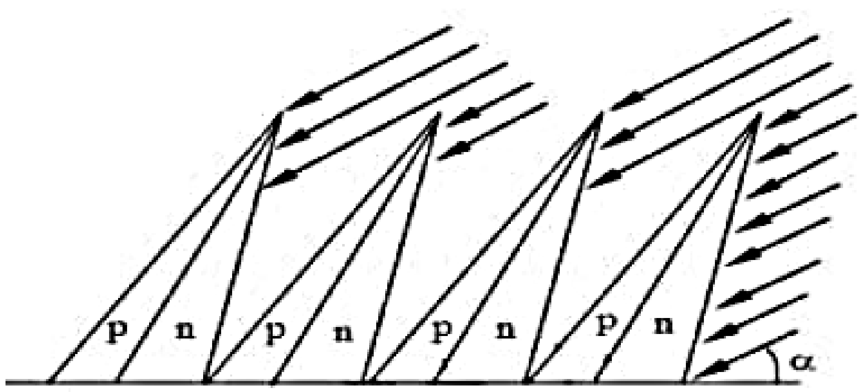

Figure 1. Structural view of film

MAIN PART

We can take semiconductor optical light receivers as sensitive elements. To date, different models of semiconductor optical light receivers have been developed, which vary in performance. The importance of optical light-sensitive elements in automated systems is enormous. These sensitive elements receive incoming light and convert it into electrical signals in a photoelectric manner. The optical sensor with the highest sensitivity in terms of spectral properties is the anomalous photo (APV) receiver. Today, it has been proven that an APV receiver can be obtained from any semiconductor material. But even an APV receiver made of any semiconductor material does not achieve high sensitivity. The advantage of APV receivers over other optical sensors is that they can operate autonomously. That is, the operation of APV receivers does not require absolute electricity, it can provide a self-powered source by generating incoming light [3,4].

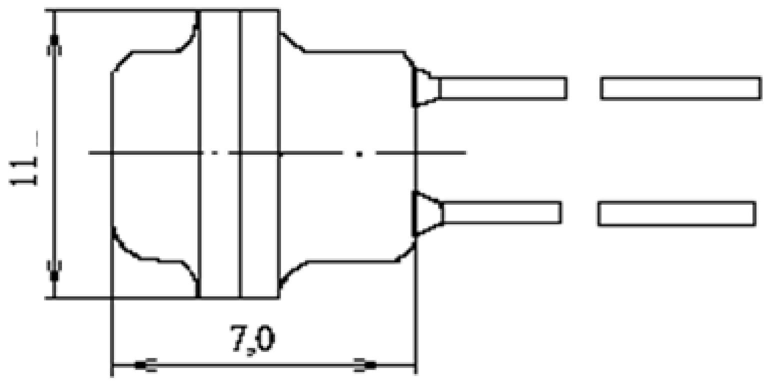

Figure 2. APV receiver appearance

Basic technical data

Sensitivity at I_V = 1 lux, V……5 Durability, h, not less …..10000

Internal resistance, Om…..10^{14} Overall dimensions, mm …….11×11×49

sensor speed, s…..1 Mass, g, ………..2,0

If we look at the mathematical model of the APV receiver, it is a multi-variable function, and this function is expressed in terms of luminous flux F, spectral composition of optical radiation L, temperature T and humidity V.

$$U_\Phi = f(\Phi, T, L, B)$$

The coefficient of variation of optical radiation of light sources (irradiated diode, laser diode) of APV receivers:

$$K = \frac{\int_0^\infty \varphi_{e.\lambda}(\lambda) S_{\text{отн}}(\lambda) d\lambda}{\int_0^\infty \varphi_{e.\lambda}(\lambda) d\lambda} \qquad (1)$$

$\varphi_{e.\lambda}(\lambda)$ – the relative dispersion spectrum of light flux coming out of the source;
$S_{\text{отн}}(\lambda)$ - relative spectral characteristics of APV receptor sensitivity.
Spectral connectivity of light flow with integrated sensitivity of APV receiver:

$$S_{\text{интФе}} = S_{\lambda.\Phi e.max} K, \qquad (2)$$

$S_{\lambda.\Phi e.max}$ - Maximum spectral sensitivity of APV receiver to light flow.
Relative spectral sensitivity of APV receiver:

$$S_{\lambda.\text{отн}} = S_{\lambda.\text{абс}} / S_{\lambda.max}, \qquad (3)$$

$S_{\lambda.\text{абс}}$ - Absolute spectral sensitivity of APV receiver;
$S_{\lambda.max}$ - APV receiver maximum spectral sensitivity.
Sensitivity of the APV receiver to the initial frequency:

$$\Phi_n = \frac{S_{отн}(\lambda)}{S_{\frac{I}{инт}}} = \frac{U_ш}{U_{u.инт}}, \quad (4)$$

$U_ш$ – noise voltage; $S_{I.инт}$, $S_{u.инт}$ – Integrated sensitivity of APV receiver with current and voltage.
Initial specific sensitivity of the APV receiver:

$$\Phi_n^* = \Phi_n\sqrt{A\Delta f} = \Phi_{n.I}\sqrt{A}, \quad (5)$$

$\Phi_{n.I.}$ - The initial unit frequency band sensitivity of the APV receiver;
A - The surface of the APV receiver; Δf - the frequency bandwidth of the amplified field.
Recommended frequency band for the measured area in APV photodetector certification:

$$\Delta f = 0{,}2\, f_м, \quad (6)$$

$f_м$ - frequency modulation in passporting.
The specific detection capability of the APV receiver.

$$D^* = \frac{1}{\Phi_n^*}, \quad (7)$$

Φ_n^* - The initial specific sensitivity of the APV receiver.

Recalculation of the spectral sensitivity of the APV receiver to the luminous flux to the spectral sensitivity to the luminous flux:

$$S_{\lambda.\Phi e} = S_{\lambda.\Phi v} K_{max} V(\lambda), \quad (8)$$

$S_{\lambda.\Phi e}$, $S_{\lambda.\Phi v}$ - spectral sensitivity to light flux and light flux; K_{max} - spectral maximum efficiency of monochromatic radiation; V(λ) - spectral relative light efficiency of monochromatic radiation for daylight (Table 1).

Spectral relative light efficiency for day vision of monochromatic radiation

Table 1.

λ, нм	300	400	500	600	700
0	-	0.004	0.323	0.631	0.0041
10	-	0012	503	503	0021
20	-	0040	710	381	00105
30	-	0116	862	265	00052
40	-	023	954	175	00025
50	-	038	995	107	00012
60	-	060	995	061	00006
70	-	091	952	032	00003
80	0.000039	139	870	017	000010
90	0.00012	208	757	0082	-

Recalculation of the parameters of the APV receiver in the given light PM (photometric magnitude), in the energy FMK parameters:

$$S_{инт.\Phi e} = S_{инт.\Phi v} K_{max} k_г; \quad (9)$$

$$\Phi_{n.e} = \frac{\Phi_{n.v}}{K_{max} k_{г}}, \quad \text{Bm}, \qquad (10)$$

$S_{инт.Фе}$, $S_{инт.Фv}$ - Integral sensitivity of the APV receiver to light flux and radiation flux; $k_{г}$ - the coefficient of radiation used by the eye; $\Phi_{n.e}$, $\Phi_{n.v}$ - The initial sensitivity of the APV receiver to energy and light PM at a given line frequency [2].

Recalculation of the parameters of the APV receiver given in energy PM for one source of radiation to the parameters in energy PM for another source of radiation:

$$S''_{инт.Фе} = \frac{S'_{инт.Фv} K''}{k'}; \qquad (11)$$

$$\Phi''_{n.Фе} = \frac{\Phi'_{n.Фv} K''}{k''}, \qquad (12)$$

$S'_{инт.Фv}$, $S''_{инт.Фе}$ - Integral sensitivity of the APV receiver to the radiation flux for the first and second source radiation; $\Phi'_{п.Фv}$, $\Phi''_{п.Фе}$ - The initial sensitivity of the APV receiver to the frequency band for the first and second source at a given energy PM.

The relationship between voltage and current of APV receiver sensitivity:

$$S_U \approx S_1 R_н , \qquad (13)$$

$R_н$ - clamoring of cartilage.

$$U_Ф \approx S_1 \Phi , \qquad (14)$$

S_1 - Sensitivity of APV receiver.

Voltage photo signal of APV receiver:

$$U_c = S_U \Phi , \quad (15)$$

S_U - Voltage sensitivity of the APV receiver [2-7].

CONCLUSION

The use of photosensitive sensors in automated systems plays a key role in system optimization and ensures system stability. In general, the use of photosensitive sensors in automated systems plays an important role with low energy consumption, noiseless operation, speed, high accuracy and reliability. The use of APV receivers as autonomous optical light receivers in automated optoelectronic systems is promising in the field.

REFERENCES

1. Optron na osnove AFN - priemnika / Alijanov D.D. // Muxammad al-Xorazmiy avlodlari, № 3 (13), sentyabr 2020 ст.64-66.
2. Raximov N.R., Alijanov D.D. Matematicheskiy model AFN – priemnika // Muxammad al-Xorazmiy avlodlari, №2(4) 2018г.
3. N.R. Raximov, A.N. Sereznov, B.N. Raximov, D.D. Alijanov (2017). Jig-sensitive optical detectors based on

semiconductor films with anomalous photovoltage // 13th International Scientific-Technical Conference APEIE.

4. D.D.Alijanov, U.A.Axmadaliyev. (2020). The Pecularities Of Automatic Headlights. The American Journal of Engineering and Technology, 13-16.
5. Photosensitive sensors in automated systems / Alijanov D.D., Boltaboyev I.M. // PHOTOSENSITIVE SENSORS IN AUTOMATED SYSTEMS // Internauka: elektron. nauchn. jurn. 2020. № 23(152).
6. Alijanov D.D. Mirzaev K.S. Usmonov J.N. Anarboev I. Soxibova Z.M. Preimuchestva ispolzovaniya AFN-elementov v avtomatizatsii [Jurnal]. - Novosibirsk : Avtomatika i programmnaya injeneriya, 2017 г.. - № 2 (20).
7. D.D.Alijanov, N.Rakhimov Optoelectronic Method for Determining the Physicochemical Composition of Liquids [Журнал]. - Новосибирск : Автоматика и программная инженерия, 2020 г.. - 32.
8. A. Yusupov, S.R.Aliev, D.D. Alijanov, J.N.Usmonov Sozdanie i nekotrie svoystva poverxnostno-barernogo perexoda Ag/Cu2 ZnSnS4 [Jurnal]. - Novosibirsk : Avtomatika i programmnaya injeneriya, 2017 g.. - 21.
9. Alijanov. D.D. Osobennosti polucheniya fotochuvstvitelnix plenok s anomalnim fotonapryajeniem [Jurnal]. - Novosibirsk : Avtomatika i programmnaya injeneriya, 2013 g.. - 5.
10. D.D. Alijanov, N.R. Raximov, V.A. Jmud Razrabotka optoelektronnix datchikov na osnove AFN-plenok iz poluprovodnikovix soedineniy [Jurnal]. - Novosibirsk : Sbornik nauchnix trudov NGTU, 2012 g.. - 68.
11. N.R. Raximov, D.D Alijanov, V.A. Jmud. Perspektivi primeneniya AFN – priemnika dlya razrabotki optoelektronnoy informatsionno – izmeritelnoy sistemi [Jurnal]. - Novosibirsk : Nauchnыy vestnik NGTU , 2014g g.. - 3 : T. 56.
12. Raximov N.R., Alijanov D.D. Osobennosti polucheniya koordinatno-chuvstvitelnogo priemnika opticheskogo izlucheniya na osnove poluprovodnikovыx plenok s anomalьnыm fotonapryajeniem. [Jurnal]. - Novosibirsk : Avtomatika i programmnaya injeneriya, 2012 g.. - 2 .
13. D.D. Alijanov, I.M. Boltaboyev . (2020). Photosensitive Sensors in Automated Systems / International Journal of Research Studies in Electrical and Electronics Engineering (IJRSEEE) , 33-34.
14. D.D. Alijanov, I.M. Boltaboyev. (2020). Development of automated analytical systems for physical and chemical parameters of petroleum products. ACADEMICIA: An International Multidisciplinary Research Journal, 631-635.
15. Olimov L. O., Yusupov A. Kh., Alijanov D. D. . (2019). Problems of Introduction of Innovative Technologies and Modern Equipment in the Fishing Industry . International Journal of Research Studies in Electrical and Electronics Engineering (IJRSEEE) , 23-25.