Modeling of a Semiconductor Matrix of Photosensitive Threshold Elements

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Abstract

Noises in photo sensors that are widely used in optical measurements limit their precision. One of the ways to make the measurements more precise (up to 1μ), when information carrier is a light beam, distributing in occasionally dispersive medium, is in use of matrix of multithreshold semiconductor photo sensors. In this case the input information is multiplied $\log_2 p$, where p is the number of different states of the element. There is a necessity of this kind of measurements in ALICE program as well.

The beam is a Hamiltonian system, thus displacement of its center of masses may be identified either as a displacement of the beam or as a result of dispersion effect in medium. If we have a matrix with dimensions – d and interelementar distance – l, taking the mean of multiple measurements we can find the above mentioned center of "masses" with a precision of (d+l) in given direction.

We have also anther representation of the model of these sensors a system of current equations for multi layer structures [1]:

$$i_1(e^{V_1}-1)+i_1\delta e^{V_1/2}+i_1\beta_2(1-e^{V_2})=j-a_1g$$
$$i_1\beta_2(e^{V_1}-1)+i_3\beta_3(e^{V_3}-1)+i_2(1-e^{-V_2})+\sigma V_2=j+a_2g$$
$$i_1(e^{V_1}-1)+i_3\beta_3(1-e^{-V_2})=j$$

Where V_i is voltage on the i junction in KT/e units, i_k - electric current density, δ - recombination index in the first emitter, β_k - index of carry in base k, σ - conductivity of shunt of collector junction, g - intensity of light flux, a_1 and a_2 positive indexes depending on sensors parameters. It is important to mention also, that the element must have the same number of optical windows as the number of wavelengths in the beam.

References

[1] H.S. Karayan. PhTS, vol. **19**, No **4**, 1334(1985).

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