FACTA UNIVERSITATIS (NIŠ)
Series: Electronics and Energetics vol. 7, No. 1, (1994), 105-107

ELECTRON–OPTICAL AND ELECTRONIC MEANS OF CORRECTION CRT ABERRATIONS IN HDT–SYSTEMS

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Abstract. Using in HDT-systems electron beam devises for reproducing pictures we have the means providing with high definition, which consists in decreasing electron-optical aberrations of CRT, which have an influence on beam focusing. The aberrations may be decreasing by correction by means of additional electron-optics elements, but the process of scanning determine necessity correction in accordance with the beam position in every time moment. That demand applying electron means of correction. There are considered electron-optical elements and the construction principles of electronic circuit which permit to realize correction.

Key words: High definition television system, cathode ray tubes, aberation, electron-beam deflection system.

1. Introduction

This paper is connected with HDT-systems in wide meaning that is includes broadcasting TV-systems and applied TV-systems of different applications which must have a high definition.

In the most events the electron-beam devices are the means of reproducing pictures in TV-systems. Then the quality of beam focusing ensures the high definition. As we know, the aberrations of focusing and deflection systems (image-field curvature, astigmatism, coma) have an influence on beam focusing. Image-field curvature and astigmatism are the most influential. Fortunately, we have the means, which permit us to correct this aberrations.

Image field curvature is corrected by the dynamic focusing of the beam. In accordance with this method we must change the optical force of the focus system in accordance with scanning. The dynamic focusing is realized both

Manuscript received February 13, 1993.
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in electrostatic and electromagnetic CRT. There are the devices in which we have special electrode for this purpose. But in electrostatic devices the voltage of the main focusing electrode is changed frequently. There is the complexity connected with comparatively high voltage of the main focusing electrode (hundreds of volts). The dynamic focusing in electromagnetic CRT by means the main focusing system is impossible, because this system has too large inductance.

Therefore in all devices (electrostatic and electromagnetic) it is reasonably to use correction element as additional electromagnetic focus system. This system has slight optical force. It may be made with low quantity of turns. It permit to reduce the system inductance and to ensure it function at the high speed of scanning.

The electromagnetic lens with four poles-quadripole lens is the means of astigmatism correction. Such a lens has four poles which create the magnetic field in zone of undeflected beam. The poles not necessarily must be as a construction elements. It is enough that the magnetic field has necessary shape. Such a field has astigmatism also, the correction element astigmatism and CRT astigmatism are mutually compensated if the both astigmatisms are accordingly orientated.

Quadripole magnetic lens has simple construction. This is an known deflection system which consist of four coils, but the coils are connected in another way and deflection field is transformed to the astigmatism correction field. This lens must be with small optical force also. It permit, from one side, to made the coils with low inductance, from another side - we have not necessity in ensuring of definite turns allocation law as in deflection systems.

Quadripole lens for astigmatism correction has an peculiarity. The astigmatism generated by CRT deflection system is changed in volume and orientation over and over during scanning. Thus we must change optical force and orientation quadripole lens poles in accordance with scanning. For that quadripole lens is complicated by the second identical lens coils of which are turned on the 45 degrees around the axis of CRT. Now we need two correcting currents. It generate resulting field with four poles. Orientation of this poles is determined by currents correlation and directions in correcting element, the intensity of correction field - by volumes of currents.

So we need dynamic focus correction current and two currents of astigmatism correction. As we can see this currents are functionally connected with scanning process, that is with the deflection CRT currents on the X and Y coordinates. The special electronic transform circuits are used for

generating this currents. About the principle of constraction this circuits may be divided in accordance with using methods:

- polynomial method,
- zone method
- interpolation-junction method.

In the case of polynomial method the correction currents (dynamic focus i_{df}, astigmatism correction one i_{a1}, astigmatism correction two i_{a2} are formed from the deflection currents (x, y) by the next way:

$$
\begin{aligned}
i_{df} &= A_0 + A_1 x + A_2 y + A_3 x^2 + A_4 y^2 + A_5 xy + \dots , \\
i_{a1} &= B_0 + B_1 x + B_2 y + B_3 x^2 + B_4 y^2 + B_5 xy + \dots , \\
i_{a2} &= C_0 + C_1 x + C_2 y + C_3 x^2 + C_4 y^2 + C_5 xy + \dots ,
\end{aligned}
$$

Corresponding mathematical operations may be realized by analog and digital methods.

Zone method foresee the division of the field of picture on the row sufficiently small zones. Necessary significations of correction signals are wrote to the electron memory and are took out in the process of scanning automatically.

Interpolation-junction method consist in writing to the memory significations of correction signals in the point of crossing (junctions) imaginary orthogonal net which is put over the screen of CRT. Correcting currents for the points between the junctions are determined by means of interpolation junction significations, for instance, with line interpolation. We have elaborate device which may to realize such interpolation for the case of digital scanning mode. Obviously, that $i - j$ method is the development of the zone method and permit to receive better correction.

In sum using discussed in this paper approach for the systems with high resolution CRT made it possible for rising resolution of CRT on the edge of screen up to $2 - 3$ times thanks to dynamic focusing and in addition up $1.5 - 2$ times thanks to correction astigmatism.

This matter is expose more in detail in [1].

REFERENCES

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