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The Hibrid Method Determinative Magnetic Fields of DY

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Introduction

Searching optimal distribution of the magnetic fields (MF) of deflection yoke (DY) is one of the most important element to achieve fine electronic-optical parameters of any CRT devices. Sometimes these magnetic fields have found empirically [1-6].The authors of the papers [1] have recommended to measure tangential component of MF on some surface points inside area of DY.Others [2-6] have suggested to measure all three coponents in 3 -D netting points and after that use interpolation technic to search MF in other points.

In the present paper a calculation method of the magnetic fields in the 3-D space is described when measurement of MF are fulfiled only in the 2-D netting points of the surface covering this space.

Distribution of magnetic fields DY

Let the surface inside area of DY be as shown in Fig.1.

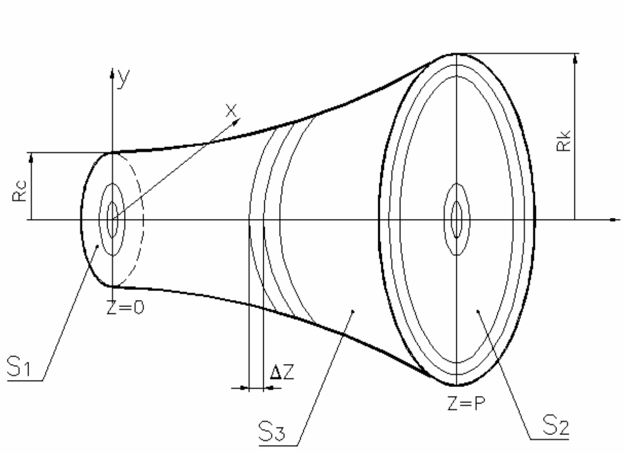

Fig.1. Basic datas of the surface S

Here we have two plane sections S_1,S_2 of the surface disposed at z=0 and z=P, and cone section S_3. Tangential components of MF H_τ are measuring in the circle R points disposed on this surface.In horizontal deflection case measured MF values can be spread in such Furje series:

$$\mathrm{H}_\tau = \sum_m B_m \cos(m\beta) . \tag{1}$$

After calculating magnetic potential

$$\psi = \mathrm{R(z)} \int_0^\beta \mathrm{H}_\tau d\varsigma , \tag{2}$$

we get harmonics ψ_m of MF

$$\psi_m = \mathrm{R(z)/m} * \mathrm{B_m} . \tag{3}$$

In other hand according well known magnetic field theory magnetic potential can be represented by simple sheet potential with charge density σ :

$$\psi = 0.25/\pi \oiint_S \sigma / |\vec{r} - \vec{r}_t| ds . \tag{4}$$

This equation after some transformes by representing integrand function σ in form simillary as (1)

$$\sigma = \sum_m \sigma_m \cos(m\beta) , \tag{5}$$

and second integrand function in Lagrange form [7]

$$1/ \Upsilon \mathbf{r} - \mathbf{r}_\mathrm{t} \Upsilon = \sum_m \theta_m \cos(m(\beta - \beta_t)) , \tag{6}$$

$$\theta_\mathrm{m} = \mathrm{R}^\mathrm{m} \xi^{-(\mathrm{m}+0.5)} \sum_n \{1*3*5*...*[2*(m+2n)-1]\}/$$
$$\{(\mathrm{m+n})!\mathrm{n}!4^{(\mathrm{m+2n})} \xi^{2\mathrm{n}}\} , \tag{7}$$

where $\xi=1+\{(\mathrm{R}-\mathrm{R_t})^2+(\mathrm{z}-\mathrm{z_t})^2\}/(2\mathrm{RR_t})$, is dividing into some separate one dimension line integral eguations:

$$\oint \sigma_m R^{-0.5} \theta_m dl = 2^{1.5} R_t^{0.5} \psi_m . \tag{8}$$

After solution them (8), make using (4) we get components of MF:

$$\begin{cases} H_\mathrm{y} = H_r \sin\beta + H_\beta \cos\beta, \\ H_x = H_r \cos\beta - H_\beta \sin\beta, \\ H_z = H_z ; \end{cases} \tag{9}$$

where

$$\mathrm{H_r} = -0.25*2^{-0.5} \sum_m (H_{r1} + H_{r2} + H_{r3}) \sin(m\beta) , \tag{10}$$

$$H_\beta=-0.25*2^{-0.5}\sum_m (H_{\beta 1}+H_{\beta 2}+H_{\beta 3})\cos(m\beta), \quad (11)$$

$$H_z=-0.5*2^{-0.5}\sum_m (H_{z1}+H_{z2}+H_{z3})\sin(m\beta), \quad (12)$$

$$H_{r3}=\int_0^P \sigma_m R^{-0.5}\left(1+R^{(1)2}\right)^{0.5}\{\theta_{m1}-2R_t\theta_{m0}+\theta_{m2}\}dz, \quad (13)$$

$$H_{\beta 3}=\int_0^P \sigma_m R^{-0.5}\left(1+R^{(1)2}\right)^{0.5}\{\theta_{m1}+\theta_{m2}\}dz, \quad (14)$$

$$H_{z3}=\int_0^P \sigma_m R^{-0.5}\theta_{m0}\left(1+R^{(1)2}\right)^{0.5}\{z-z_t\}dz, \quad (15)$$

$$\theta_{mi} = R^{mi}\,\xi^{-(mi+0.5)}\sum_n \{1*3*5*\ldots*[2*(mi+2n)-1]\}/ \{(mi+n)!n!4^{(mi+2n)}\,\xi^{2n}\}, \quad (16)$$

where mi=: i=0,1,2; m0=m, m1=m-1, m2=m+1, and analogic to (13-15) expressions for surface sections S_1 and S_2.

Experiment

The experimental verifying of this create method was carried out using the type of masproduction DY unit VV2920. This type of DY is very good for this purpose because is highly complicated. It use to work with 29” A68 QCP891X CRT. The DY have additionally magnets and sixpole magnetic circuit for compensate picture distortions of CRT. According method conus basic datas were taken R_c =10mm, R_k=120mm.The compare experimental and calculation results of MF were done on the two cylindrical surfaces which radius were 10mm and 35mm.We have been found very good matcing between results.

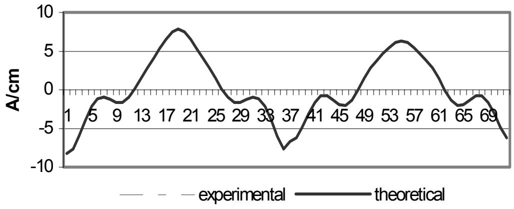

Fig. 2. MF in the middle area of DY; R=35mm

Fig.2 … Fig.5 presents typical datas of tangential components MF obtained on these cylindrical surfaces. Having calculated and additional having measured of datas were done on the two crossections of axial axis z disposed over 5mm each of other in the netting points with step 10˚. So points 1…36 presents the first crossection and last points - the second crossection.

Conclusions

The performed invesigations show that according new method it is possible to get precision MF distribution in all 3-D space of DY used only measured datas on the surface covering this space.

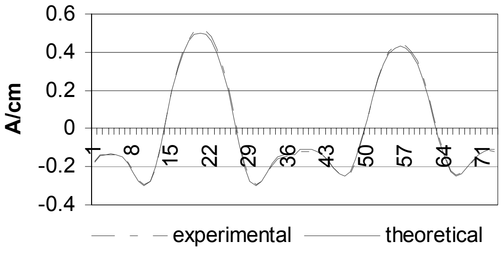

Fig. 3. MF in the end area of DY; R=35mm

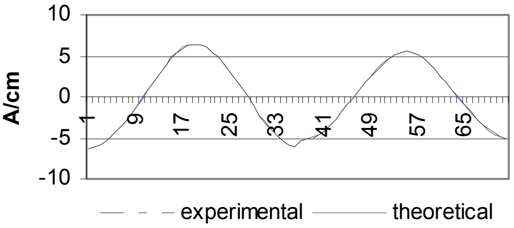

Fig. 4. MF in the middle area of DY; R=10mm

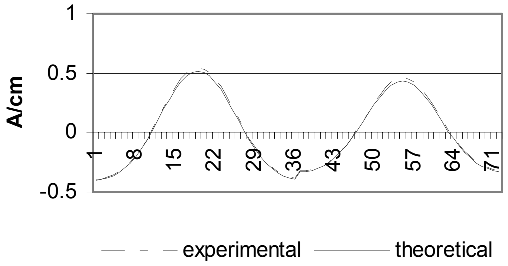

Fig. 5. MF in the end area of DY; R=10mm

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R. Matuliauskas. Kombinuotas KS magnetinių laukų aptikimo metodas // Elektronika ir elektrotechnika. - Kaunas: Technologija, 2004. - Nr.5(54). – P.15-17.

Gerai žinomo ir plačiai literatūroje aprašomo metodo, įgalinančio iš trimačio tinklelio taškuose, išmatuotų magnetinio lauko (ML) verčių atkurti jo struktūrą tarpiniuose taškuose, trūkumas būtų pernelyg didelis matavimo darbų imlumas siekiant apibrėžti ML didesniuose tūriuose, pavyzdžiui, kreipiamųjų sistemų (KS). Remiantis naujuoju metodu ML struktūra trimatėje erdvėje surandama teoriškai, pasinaudojant tik magnetinio lauko, išmatuoto tą erdvę gaubiančio paviršiaus tinklelio taškuose, tangentinėmis dedamosiomis. Pateikiami palyginamieji kreipiamosios sistemos VV2920 matavimo ir skaičiavimo rezultatai. Il. 5, bibl. 7 (anglų kalba, santraukos lietuvių, anglų ir rusų k.).

R. Matuliauskas. The Hibrid Method Determinative Magnetic Fields of DY // Electronics and Electrical Engineering.- Kaunas:Technologija, 2004. - No.5(54). - P. 15-17.

It is very widely known method to search magnetic field (MF) values in the area between 3-D netting points where was having measured MF. According new method MF distribution in this space is found theoretically used only measurements of MF values were fulfilled only in the 2-D netting points of the surface covering the 3-D space. There are have presented comparison results of the calculation and empirically datas of deflection yoke VV2920. Ill. 5, bibl 7 (in English; summaries in Lithuanian, English and Russian).

Р. Матуляускас. Комбинированный метод определения магнитных полей ОС // Электроника и электротехника. - Каунас: Технология,2004. – № 5(54). – С. 15-17.

Известный апроксимационный метод определения магнитных полей (МП) отклоняющих систем в промежуточных точках, по данным измерений, произведённых на сетке 3-Д пространства. Согласно представленному методу распределение МП во внутреннем пространстве ОС определяется теоретически. Как показано в работе, при этом достаточна информация о магнитном поле только в точках поверхности, огибающей это пространство. Ил. 5, библ. 7 (на английском языке; рефераты на литовском, английском и русском яз.).