The numerical modeling of a shape recognizing of a ferromagnetic piece

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Abstract *– These papers are focus on the shape recognizing in the industrial medium, base on the inductive method.*

The study are made on of model of a work piece, and the method use two coils, one of them name "inductor coil", and are supplied in alternative current, and the second coil, name "sensor coil" who perform a signal in concordance with the shape of the work piece.

Keywords: *shape recognizing, inductor coil, sensor coil*

I. INTRODUCTION

In the industrial processes, especially in the selection of the shape of the ferromagnetic materials pieces, the automatization of the process is welcome, especially from the point of view of the increasing of the production efficiently.[1,2]

For the rentabilisation of this operation, it is use different method base on different technical principle of the shape recognize. (mechanical method, optical method, etc.)

In the case of the pieces made by ferromagnetic materials, one of the method, is the inductive method, and for that in this paper it was made a study about the recognize of the shape, base on the electromagnetic inductive principle.[4].

Because, for the modeling, it was use software who works with the shape that has axisimetrical shape, the study was made on the pieces that have this particular shape.

In the next picture it is represent, the work principle of the method, which was propose.

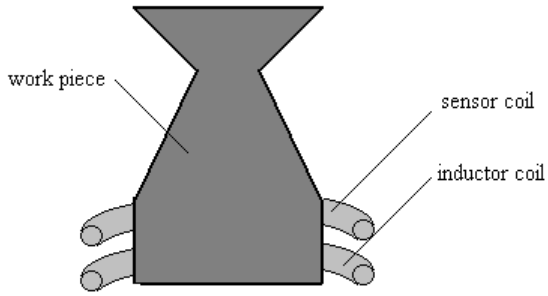

Fig.1 The work principle of the method

The principle it is consist, by using of two coils, and the axisimetrical piece it will move in the internal zone of this two coils.

One of the coil, to name "inductor coil" it is supplied with alternative current, with constant value, and in the second coil, to name "sensor coil" a tension will be induced. The value of this induced tension depending by the magnetic parameter of the medium from the interior size of the coils and this magnetic parameter depend by the shape of the ferromagnetic piece.

When the ferromagnetic piece it is move in the internal part of the coils, to the terminal of the sensor coil it is possible to evidence a signal, "stamp signal". This stamp signals it is possible with an "etalon signal" to compared, and from this comparation it is possible to recognition the shape of the ferromagnetic piece.

The numerical modeling of the function of this system it is made by using FLUX2D software, base on the FEM method.

In the time of the simulation it is possible to be monithorise the value of different parameters, in function of the relative position of the coils system and the ferromagnetic pieces.

II. NUMERICAL MODELLING

As well it was show in the anterior part, the modeling of the study domain it was made in FLUX2D software, base on the FEM method. Because the work piece and the coils system have a symmetrical axe, the geometry of the study domain it was build on the half part. The study domain it is representing in the next picture.

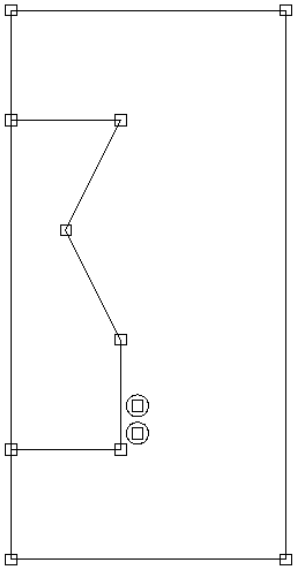

Fig.2 The geometry of the study domain

Because the more interest part of the study domain it is in the inductor coil zone, and the sensor coil zone, the mesh it was denser in this area. The picture number 3 showed the mesh for the first relative position of the coil system.

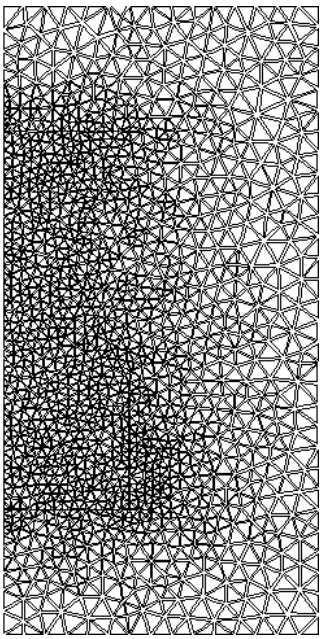

Fig.3. The mesh of the first position of the coils

The numerical simulation proposes to supply the inductor coil with 10V alternative tension, and work frequency it is 50Hz.

The monitories value to the sensor coil level it is the flux density. For this first part of the modeling, the results it is show in the next figure.

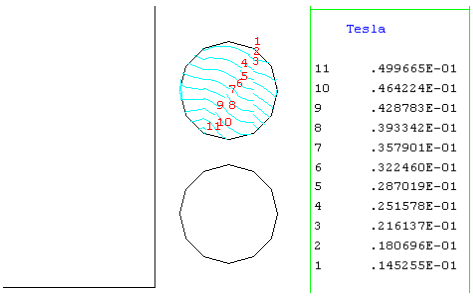

Fig.4 The flux density distribution, and the flux density value, for the first situation of the coils system dispose

For the next part of the study, the coils system are dispose in the part of the work piece, where appear a modify of the shape. This situation it is show in next picture.

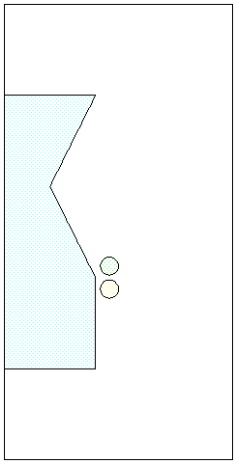

Fig.5 The second position of the coils system

The results of the numerical simulation it is shown in the next figure.

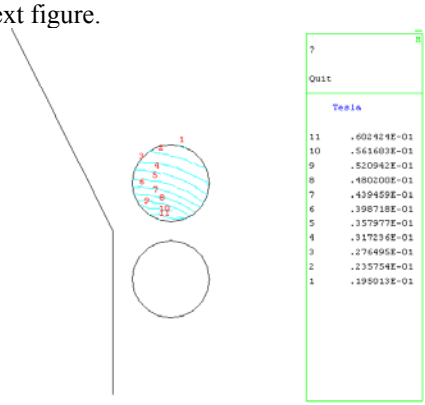

Fig.6 The flux density distribution, and the flux density value, for the second situation of the coils system dispose

In the continuation of the study the coils system it was moved in the next position were the work piece have a significantly modification of the shape.

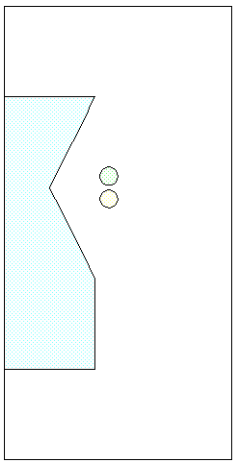

Fig.7 The thirty position of the coils system

The results of the numerical simulation, for this case are represented in the next picture.

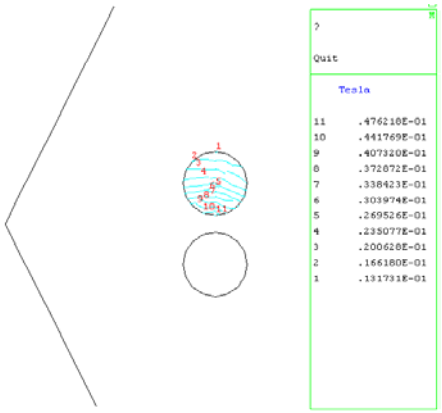

Fig.8 The flux density distribution, and the flux density value, for the thirty situation of the coils system dispose

The next step of the study consists in the move of the coils system to the final part of the work piece. This situation it is possible to see in the next picture.

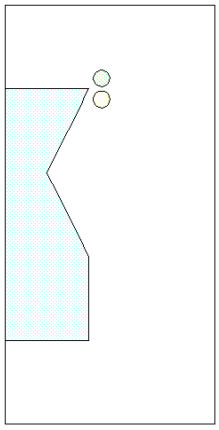

Fig.9 The fourth position of the coils system

The results of the numerical simulation for this part of the study it is represented below.

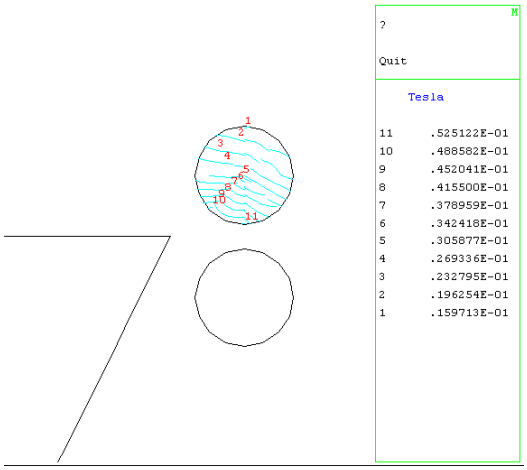

Fig.10 The flux density distribution, and the flux density value, for the fourth situation of the coils system dispose

The last part of the study it is consist in the upper dispose of the coils system, as is possible to see in the next picture, and in figure number 12 it is show the results who was obtained for this situation.

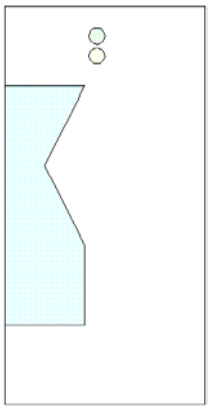

Fig.11 The five position of the coils system

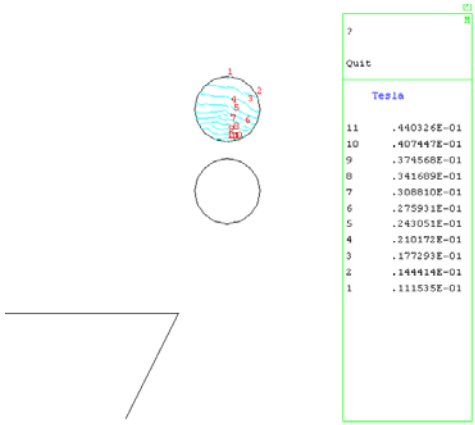

Fig.12 The flux density distribution, and the flux density value, for the five situation of the coils system dispose

The results of this numerical modeling were mediated for the each position of the coils system, and the results it is presented in the next table.

TABLE 1. The results of the study for each position

Position	Flux density value [T]
1	0,322460 E-1
2	0,398718 E-1
3	0,329327 E-1
4	0,303974 E-1
5	0,342418 E-1
6	0,275931 E-1

Base on this results it was build a diagram, which represent the "stamp" of the work piece shape. This diagram it is representing in figure number 13.

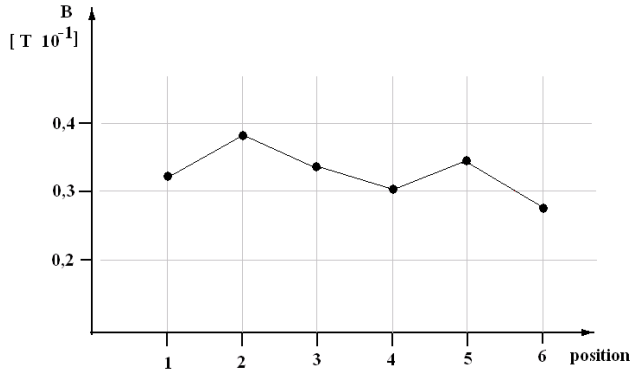

Fig.13. the diagram who represent the "stamp" of the study work piece

III. CONCLUSIONS

In conclusion it is possible to see that the relative moving of the coils system, along the work piece, give a specific stamp, according with the shape of the work piece. This specific stamp it is possible to be use in an automatically system for selected the work piece who have manufactories default.

The multiplication of the point of the analyze, give a bigger precision of the system.

To this study it is possible to make an optimization of the determination, by the point of view of the value of the supply tension and the value of the work frequency. This point will be the next step of the research.

IV. REFERENCES

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