INDUCTIVE TECHNOLOGY USE IN SHAPE RECOGNIZING OF A FEROMAGNETIC PIECE

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Abstract: This paper is focused on a theoretical study about the recognition of shapes, base on the inductive method. The study is made on a model of a work piece, with external variable shape. The method uses two coils, one of them named "inductor coil", and are supplied in alternative current, and the second coil, named "sensor coil" who performs a signal in concordance with the shape of the work piece.

Keywords: shape recognizing, inductor coil, sensor coil

1. INTRODUCTION

In the industrial processes, especially in the selection of the shape of the ferromagnetic materials pieces, the automatization of the process is welcomed, especially from the point of view of the increasing the production efficiently. [1, 2] This operation, uses different methods based on different technical principles of the shapes recognition (mechanical method, optical method, etc.) each of them has advantages and disadvantages regarding the precision of the method and the price.

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

Because, the pieces are simetrical , only half of the were analyzed.

In the next picture, the work principle of the method, which is proposed , is represented. The principle consist , of using two coils, and the piece will be moved in the internal zone of two coils. One of the coil, named "inductor coil" is supplied with alternative current, with constant value, and in the second coil, named "sensor coil" a tension will be induced.

The study method, which is proposed in this paper, consists in the induction of a variable magnetic field, by the inductor coil in the "sensor coil". The value of the magnetic induction measured to the level of one sensor coil, which is disposed near the inductive coil, depends by the material parameters of the medium between them. The magnetic parameters of this medium depend on the shape of the ferromagnetic piece (depends on the rapport of the ferromagnetic material and the air)

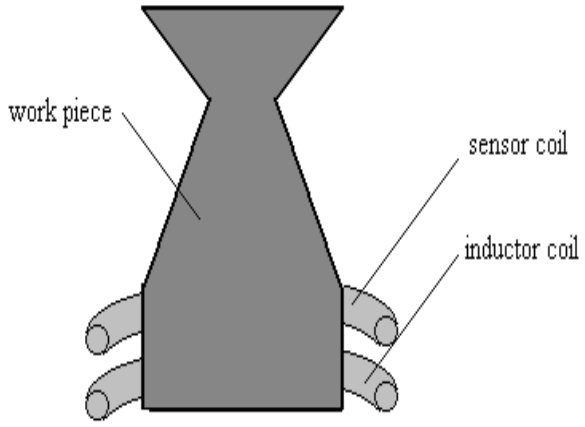

Fig.1. The work principle of the method

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

2. THE NUMERICAL MODELING AND SIMULATION

The numerical modeling and simulation, witch are proposed in the study, use the

FLUX2D software, which are based on the finite element method (FEM) and because the shape of the device has axial symmetry the study was made only on the half part of the domain. To distingue the influence of the material shape, the monitories parameter was the flux density at the level of the sensor coil, along the work piece. In the study were analyzed six particular points were the shape of the work piece had major modifications.

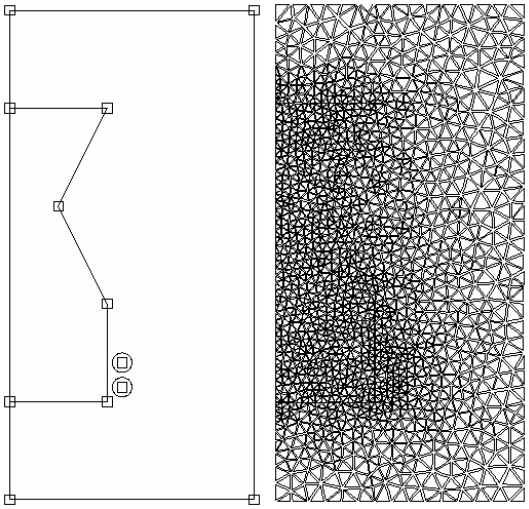

Fig.2. The first point of the study, and the corresponding mesh

The upper picture presents the study domain and the position of the coils in the first point of the study, and in the same time presents the corresponding mesh. Because the part of the study domain that presents the most importance is in the inductor coil zone, and the zone of the sensor coil, the mesh is denser in this area. The numerical simulation proposes to supply the inductor coil with 10V alternative tension, and work frequency of 50Hz. For this first part of the modeling, the results are shown in the next figure.

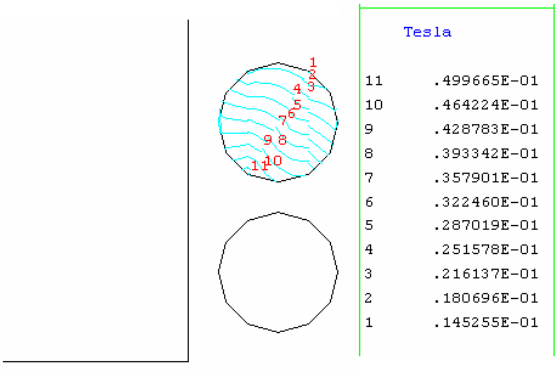

Fig.3.The value of the flux density for the first point of the study

For the next part of the study, the coils system are disposed in that work piece part, where a modification arises. This situation and the results of the simulation are shown in next picture.

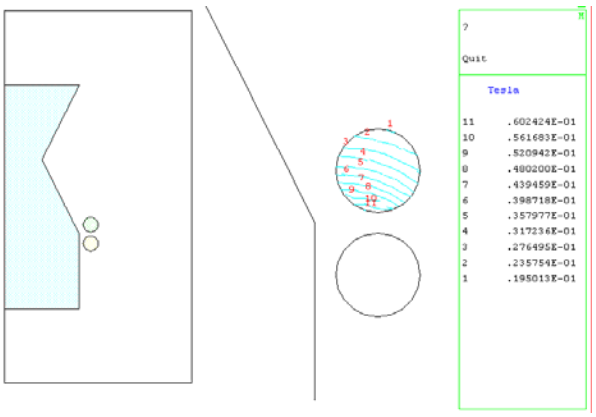

Fig.4.The position of the coils and the value of the flux density

The picture number 5 and 6 represent the position of the coils in the points were the shape of the study piece has representative modification. In the same picture the results of the value of the flux density corresponding to each position are represented.

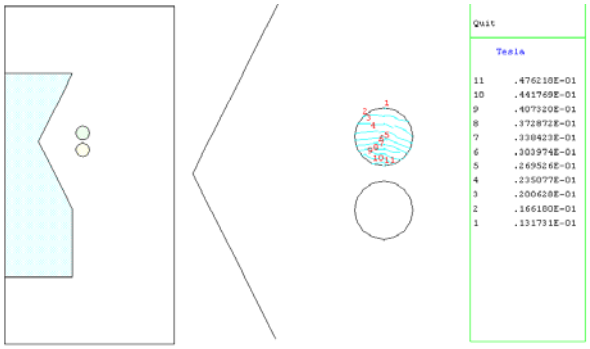

Fig.5. The position of the coils and the value of the flux density for the third point of the study

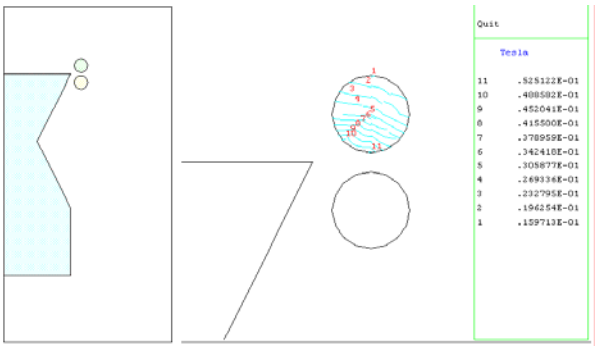

Fig.6. The position of the coils and the value of the flux density for the four point of the study

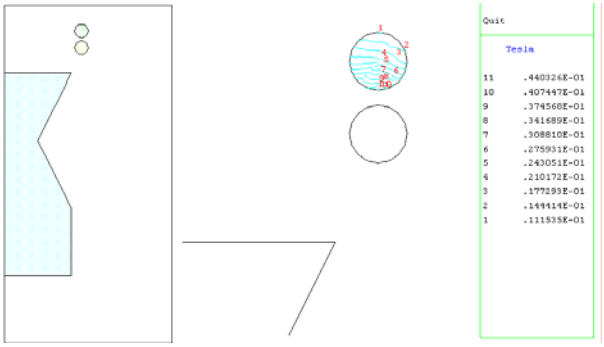

Fig.7. The last study position of the coils and the value of the flux density

The last part of the study consist in the upper disposing of the coils system, as it is possible to see in the upper picture, and the results that were obtained for this situation are show in same figure.

The results of this numerical modeling were mediated for each position of the coils system, and the results are 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 a diagram was built, which represents the "stamp" of the work piece shape. This diagram is represented in figure number 13.

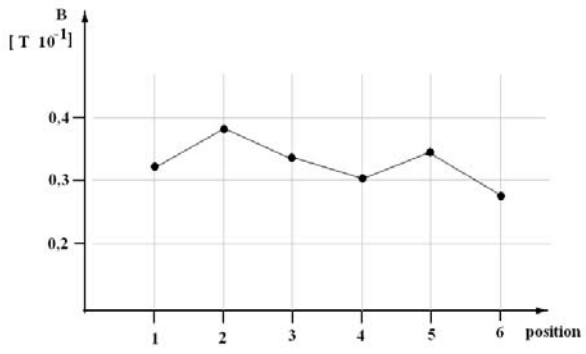

Fig.8. The diagram who represent the "stamp" of the first part of the study

3. CONCLUSION

In conclusion it is possible to see that the relative moving of the coils system, along the work piece, gives a specific stamp, according to the shape of the work piece. This specific stamp is possible to be used in an automatically system for selecting the work pieces which have manufactories problems. The multiplication of the analyzing points, give a bigger precision to the method.

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