DECIPHERING AN EXISTING DESIGN GEROTOR HYDRAULIC GEAR PAIR

Stanislav Aleksiev[1], Nikola Nachev[2], Emil Velev[3]

[1]Associate Professor, Doctor of Engineering, Department of Mechanical Engineering and Technologies, Technical University of Sofia, Branch Plovdiv, 25 "Tsanko Dyustabanov", Plovdiv, 4000, Bulgaria, stanislav_al@abv.bg
[2]Doctoral student, Department of Mechanical Engineering and Technologies, Technical University of Sofia, Branch Plovdiv, 25 "Tsanko Dyustabanov", Plovdiv, 4000, Bulgaria, eng.nachev@gmail.com
[3]Doctoral student, Department of Mechanical Engineering and Technologies, Technical University of Sofia, Branch Plovdiv, 25 "Tsanko Dyustabanov", Plovdiv, 4000, Bulgaria, emil_velev@yahoo.com

Abstract: *In this paper is presented a methodology for deciphering the gear pair of an existing gerotor hydraulic machine to improve hydraulic and technological parameters or repair work.*

Keywords: *deciphering, gerotor hydraulic machine, gerotor pump, hydraulic motor, methodology, gear couple*

1. Introduction.

Deciphering an existing gerotor hydraulic gear pair is required when making repairs or analyzing existing structure to improve hydraulic and technological parameters. This determines the relevance of the topic.

The main objective of this work is to establish a methodology for deciphering an existing gerotor hydraulic gear couple.

The name gerotor name or birotor comes from the fact, that such hydraulic machines (pumps (Figure 1, a) and hydraulic motors (Figure 1, b)) have two working rotating bodies, i.e. two rotors. The axes of the two wheels involved in gear couple – internal and external are set off from one another relative to the distance e (eccentricity) [2].

After disassembling, the gerotor hydraulic machine is seen as shown in Figure 1, a.

a) b)

Figure 1

To decipher the tooth gear shown in Figure 2 it is necessary to take the needed geometric and constructive parameters. These parameters are used to draw an equation, which controls a CNC machine for making sprockets profile.

Figure 2

The outer gear is composed of parts of arcs of circles, arranged in a circle with radius R (Figure 3). The internal gear is a curve 2, equidistant to the cycloid curve 1 (Figure 3), shifted to distance r (radius of the arcs of circles).

The equation of the cycloid curve passing through the centers of the arcs of circles is:

$$\begin{cases} x = (R+e)\cos t - e\cos\big((n+1)t\big) + e \\ y = (R+e)\sin t - e\sin\big((n+1)t\big) \end{cases} \quad (1)$$

Where:

R – Radius of the base circle passing through the centers of the arcs of circles;

n – Number of teeth of the internal gear;

e – Eccentricity;

t – Variable (0 ÷ 360)°.

To decipher the gear it is necessary to obtain numerical values of the above parameters, depicted in the diagram (Figure 3).

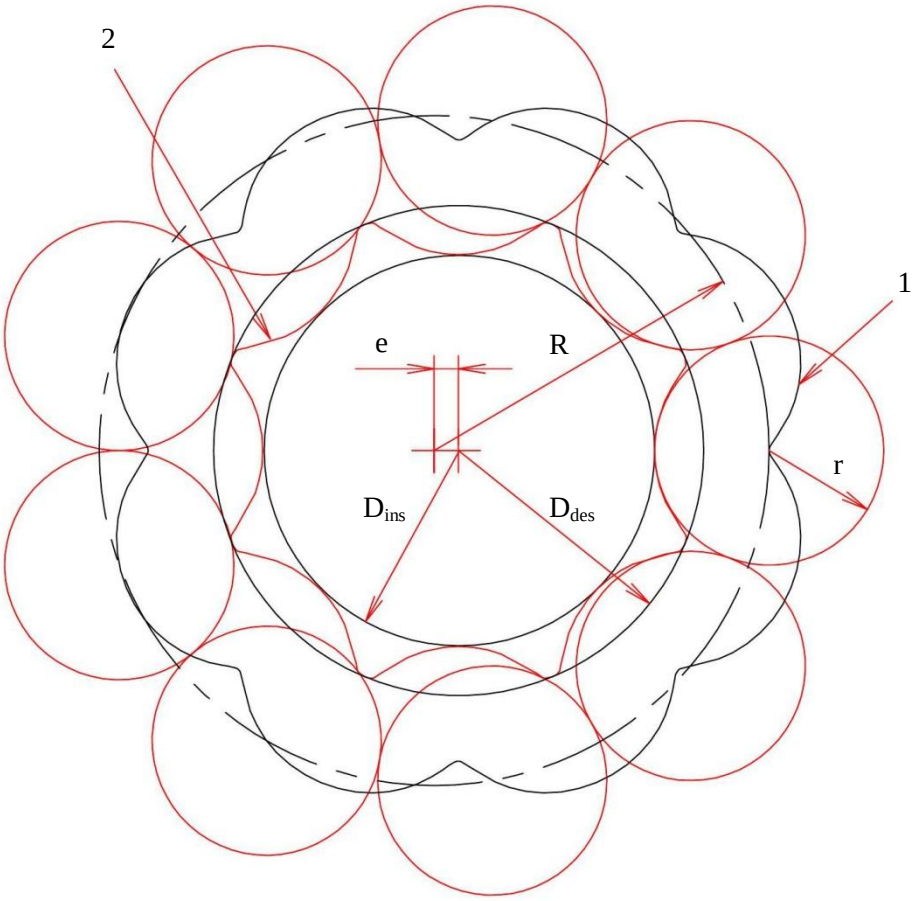


Figure 3

2. Methodology to decipher.

2.1. Measurements on the external gear.

Figure 4 shows the external gear. To determine the size of arcs of circles and their centers it is necessary to take the following measurements: using three points a circle can be constructed and it's center determined. The measurements have been made according to the diagram shown in Figure 4. Using three points measured on the arcs a circle is defined with radius and center. Three measured arcs define the circle, on which lie the centers of arcs of circles. The radius of this circle is R (Figure 3) from equation (1).

Figure 4

All measurements have been made on ABERLINK 3D measuring machine shown in Figure 5.

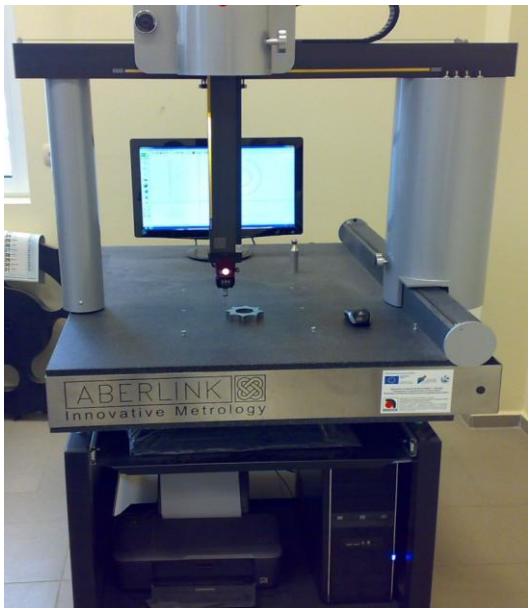


Figure 5

The results of the measurements of the external gear are shown in Figure 6.

Figure 6

2.2. Measurements on the internal gear.

Figure 7 shows the internal gear and the measuring diagram. After four measurements values for the diameters of the inscribed (D_{ins} from Figure 3) and described (D_{des} from Figure 3) circles of the wheel are obtained.

$$e = \frac{D_{des} - D_{ins}}{4} \qquad (2)$$

Where:

D_{des} – diameter of the described circle.
D_{ins} – diameter of the inscribed circle.
e – eccentricity. From equation (1).

Figure 7

The results of the measurements of the internal gear are shown in Figure 8.

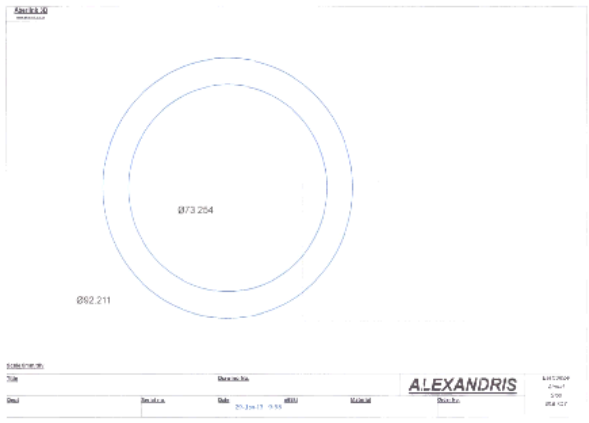


Figure 8

After substituting the parameters with their numerical values obtained from measurements made in 2.1. and 2.2. equation (1) can be solved, which finalized the deciphering of the tooth gear.

Based on the measurements the gear couple shown in Figure 2 has been deciphered, obtaining the following figure [1]:

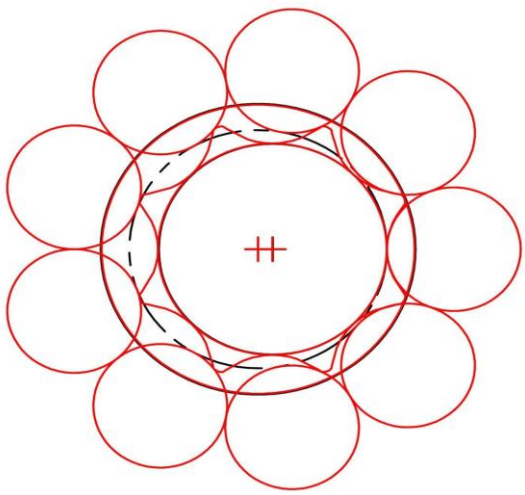
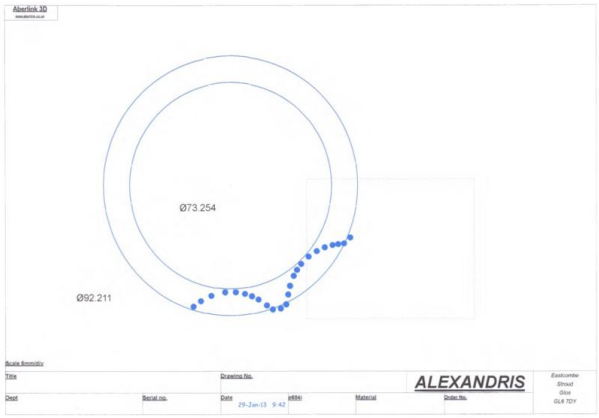


Figure 9

After constructing the figure control measurements of a certain number of points from one tooth can be taken and compared with the purely theoretical non-clearance gearing shown in Figure 9.

Control measurements of points from one tooth of the deciphered internal gear are shown in Figure 10.



After analysis of the geometric and the real dimensions, the clearance, in gear are determined.

3. Results.

Methodology for deciphering an existing gear couple of gerotor hydraulic machine has been created, thus fulfilling the objective of this paper.

4. Bibliography

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