METHODOLOGY FOR CONSTRUCTING THE GEAR COUPLE OF A GEROLLER NON-SEPARATOR HYDRAULIC MACHINE

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Abstract: *This paper presents a methodology for the construction of a geroller non-separator gear couple for a hydraulic machine and the diameters of the rollers comply with the standard ones.*

Keywords: *gerotor, gear couple, hydraulic machine, geroller hydraulic machine, non-separator*

Introduction.

Manufacturing and assembling of the working couple of a gerotor hydraulic machine requires very high precision and accuracy. An important prerequisite to achieve this high manufacturing precision is the proper design and construction of the geometry of the gear pair.

The objective of this work is to develop a methodology for constructing the gear couple for a geroller non-separated hydraulic machine.

Methodology.

Data:

$D_{ins} \pm \Delta$ – Internal diameter, on which the rollers roll, forming the outer gear (Figure 1).

n – Number of teeth of the internal gear.

Necessary to Find:

The profile of the internal gear with maximum eccentricity without tapering of its teeth;

The diameter of the rollers is to comply with the standard line rollers (D_{st}).

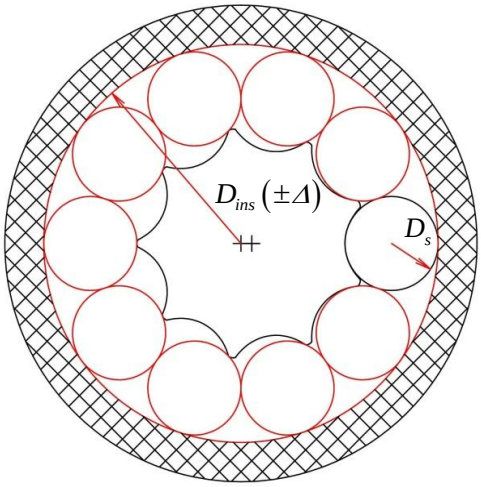

Figure 1

Building of methodology:

1. A point with coordinates (0,0,0) (Figure 2) is plotted [1].

2. An epicycloid curve (Figure 2) with initial coordinates (0,0,0) with the following equations is plotted:

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

Where:

R – Radius of the base circle;
n – Number of teeth of the internal gear;
e – Eccentricity,
$e < \frac{R}{n}$ (a prerequisite for receiving a shortened epicycloid);
t – Variable $(0° \div 360°)$.

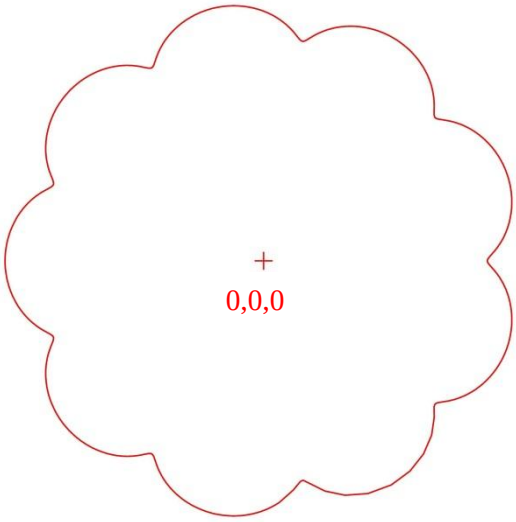

Figure 2

3. A the point with coordinates (-e,0,0) (Figure 3) is plotted.

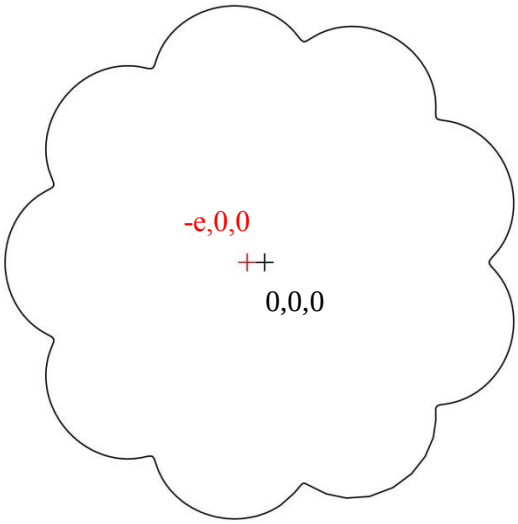

Figure 3

4. A horizontal line with length equal to $R+e$ (where R - radius of the base circle; e - eccentricity) is plotted with first point (-e, 0.0) and second point at the beginning epicycloid (Figure 4).

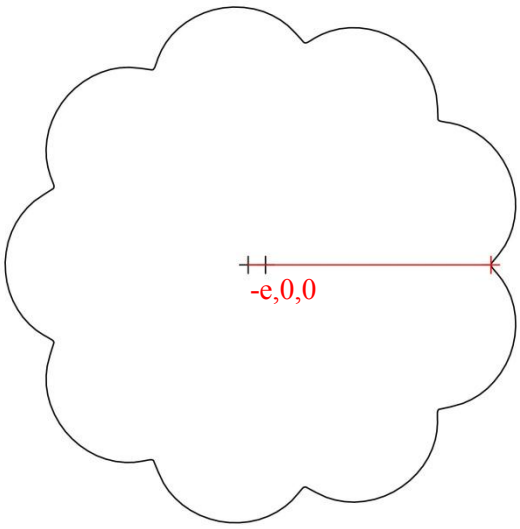

Figure 4

5. The plotted line from point 4 is rotated and copied once (Figure 5) around a point (-e, 0.0) at an angle $\alpha = \left(\frac{360°}{n+1}\right)$.

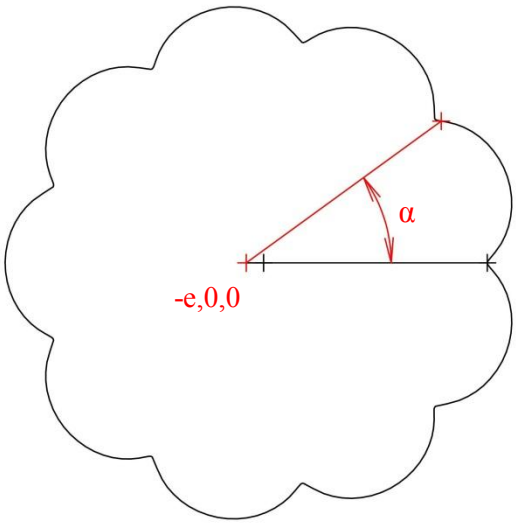

Figure 5

6. A line segment between the two endpoints of line 1 and line 2 is plotted (Figure 6). The midpoint of the new line segment is plotted.

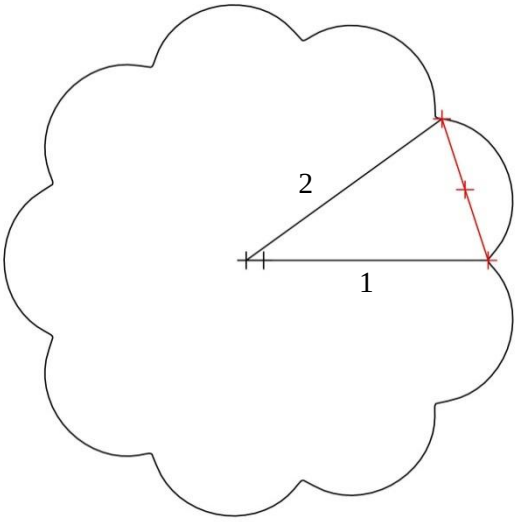

Figure 6

7. A circle with center endpoint of the horizontal line 1 passing through the midpoint is plotted (Figure 7). The radius r of the circle is equal to the radius of the rollers forming the external gear.

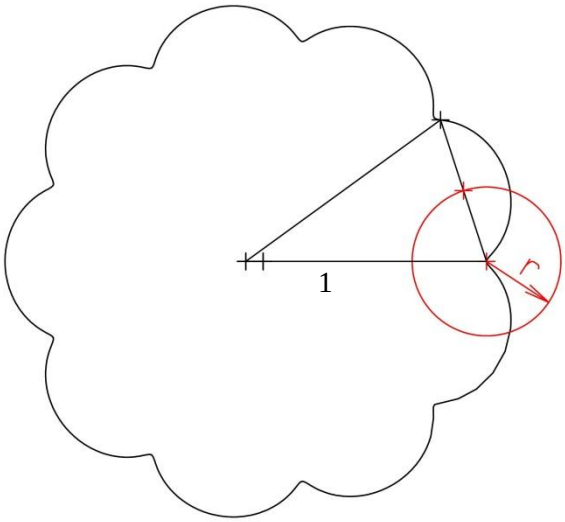

Figure 7

8. A parallel epicycloid curve inward is plotted, at a distance equal to radius r, deleting auxiliary line segments (Figure 8). The parallel curve should not be sharpened. When sharpening, occurs smaller eccentricity is chosen in the epicycloid equations.

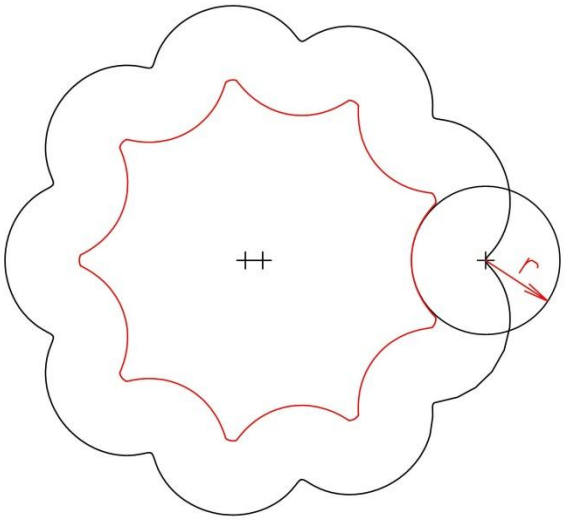

Figure 8

9. The remaining rollers of the geroller gear couple are plotted (Figure 9). This is done by rotating and coping the circle with radius r around a point (-e, 0.0) at an angle $\alpha = \left(\frac{360°}{m}\right)$, where m – is the total number of rolls $m = n + 1$. Plot a circle, in which rollers roll - with center in point (-e, 0.0) and radius $r_{out} = R + e + r$, where: R ¬ radius of the base circle; e - eccentricity; r - radius of the roller . The epicycloid is erased, leaving only the resulting parallel curve.

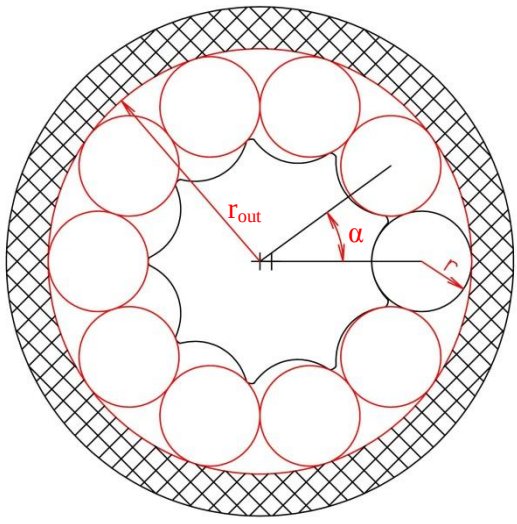

Figure 9

10. The resulting geroller gear pair is scaled by a factor $K_m = \frac{D_{ins}}{2r_{out}}$.

11. The gear pair is scaled by a factor K_r to choose the nearest standard diameter of the rollers (Figure 10).

$$K_r = \frac{D_{st}}{2r_m} \quad (2)$$

Where:

D_{st} – the closest standard diameter of the rollers;

r_m – radius of the roll after scaling the geroller gear pair by a factor of K_m.

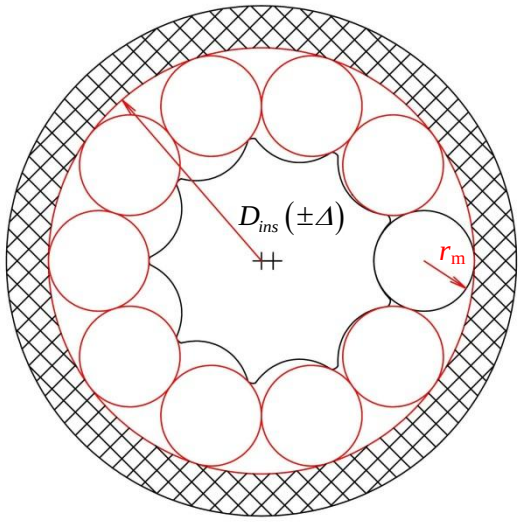

Figure 10

Conclusion.

Method for constructing a gear couple for geroller non-separator hydraulic machine is presented.

Bibliography.

[1] SolidWorks CAD Software.

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