THE *MATLAB* MODULE FOR TECHNOLOGICAL PROCESSING OF THE STAKE BETWEEN ELLIPTIC PISTON AND VOLUMETRICALLY CHAMBER AT THE HYDRAULIC MOTOR WITH ROTARY ELLIPTIC PISTON

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To specify, a little distance exist permanent between the ellipse and interior profile of the curvilinear triangle, because the presence irrationals numbers in the expression of calculus of the radius *R* of triangle arcs. It is observing in times of functioning what the stake between elliptic piston and volumetrically chamber it is gowning, to the speak of the curvilinear triangle, only for tenuous ellipse (fig.1).

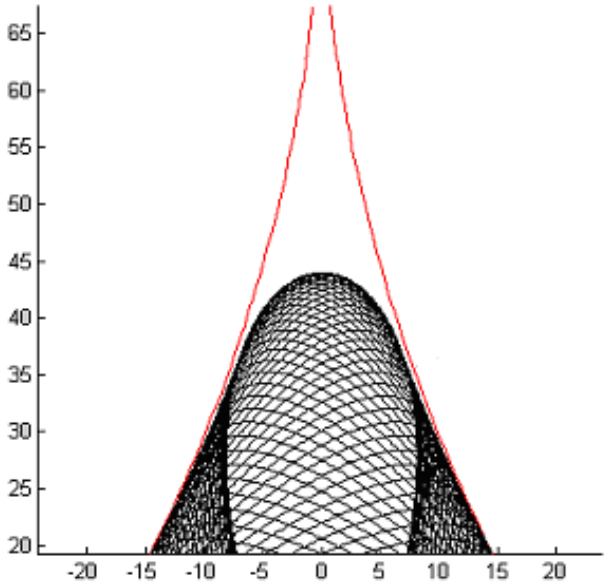

Fig. 1 The stake between elliptic piston and volumetrically chamber is growing up at the speak of curvilinear triangle

In the paper we show how the stake between elliptic piston and volumetrically chamber, has been used to calculate by Soft MATLAB, that which determine with the precision 10^{-3} [mm], represented in finally into a diagram. The stake between elliptic piston and volumetrically chamber must be positive overtimes for a good lubrication.

This soft it is abide by the *permanent calculus of the difference minimal* between segments C_3E - distance from circle's centre C_3 at ellipse's contour and C_3A –radius *R* of the circles with formed curvilinear triangle (fig. 2).

The intersection between segment C_3E with circle of curvilinear triangle with radius:

$$R = (a+b)\left(2+\sqrt{3}\right)\frac{\sqrt{3}}{2}\,[mm].$$

So, is taking the coordinates for one point from the ellipse $E(x_E,y_E)$ **,** with is calculate on base by relations from the system with parametrically equations (1), x_E and y_E have the expressions:

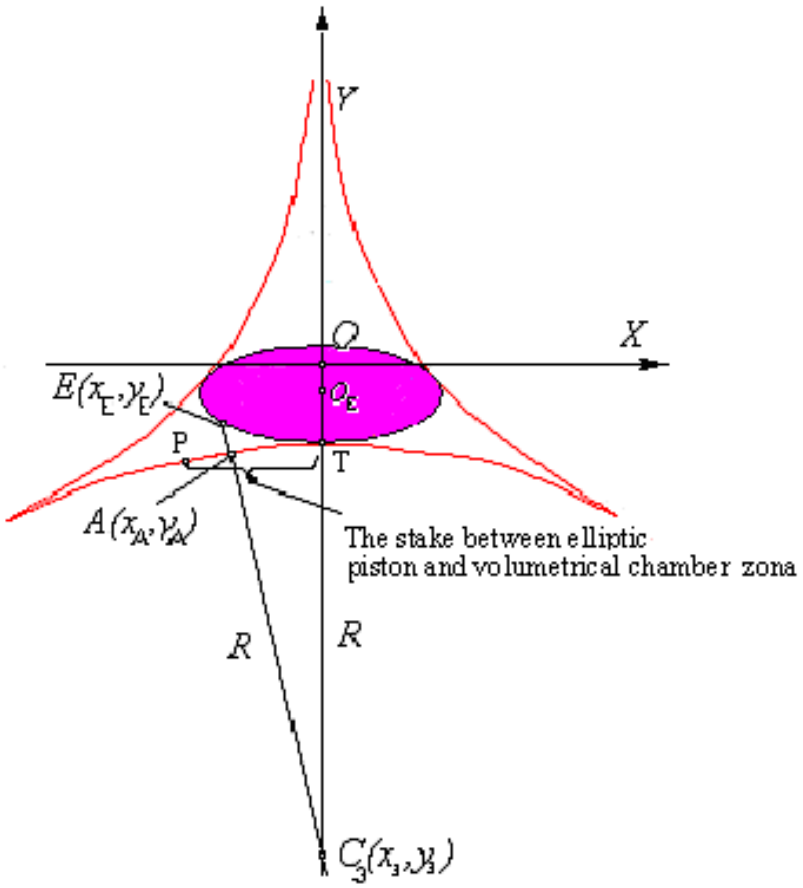

Fig. 2. The stake between elliptic piston and volumetrically chamber is the difference between the segments EC_3 and AC_3, witch is growing up at the speak of curvilinear triangle

$$\begin{cases} x_E = a\cos\theta\cdot\cos\varphi + b\sin\theta\cdot\sin\varphi + \dfrac{a-b}{2}\cos\left(\dfrac{3\pi}{2}+2\varphi\right) \\ y_E = a\cos\theta\cdot\sin\varphi - b\sin\theta\cdot\cos\varphi + \dfrac{a-b}{2}\sin\left(\dfrac{3\pi}{2}+2\varphi\right) \end{cases} \quad (1)$$

a and b are the ellipse's parameters, θ and φ - are the angles by local for one point on the ellipse (θ) , marked by rotation of ellipse (φ) referred at the axis *Ox*.

Difference $C_3E - C_3A$ on calculated by relation:

$$C_3E - C_3A = \left[\left(x_{C_3} - x_E\right)^2 + \left(y_{C_3} - y_E\right)^2\right]^{1/2} = \left[\left(x_E\right)^2 + \left(\frac{2R\sqrt{3}}{3} + y_E\right)^2\right]^{1/2} =$$

$$= \left\{\left[0 - a\cos\theta\cos\varphi - b\sin\theta\sin\varphi - \frac{a-b}{2}\cos\left(\frac{3\pi}{2}+2\varphi\right)\right]^2 + \right. \quad (2)$$

$$\left.\left[\frac{2R\sqrt{3}}{3} + a\cos\theta\cos\varphi - b\sin\theta\sin\varphi + \frac{a-b}{2}\sin\left(\frac{3\pi}{2}+2\varphi\right)\right]^2\right\}^{0,5};$$

Translation in Language of *MATLAB* of the relation (2), implicated first writing the distance C_3E by function R(j):

R(j)=sqrt((x(j))^2+(y(j)+(a+b)*(2+sqrt(3)))^2); (3)

By means introducing the operator for calculation:

[E(i),k] = min(abs(R)); (4)

we find the small value for segment C_3E, for any position of ellipse by rotation inside of curvilinear triangle. The difference of segments $C_3E - C_3A$ is converting by relation e(i), that is:

e(i) = [E(i)-((a+b)/2)*(2+sqrt(3))*sqrt(3)]; (5)

Translation in Language of MATLAB the formers relations, is revealed to inferior place
and will represent into figure MATLAB, the diagram of stake maxim between elliptic piston and volumetrically chamber:

```
R(j) = sqrt((x(j))^2+(y(j)+(a+b)*(2+sqrt(3))+c)^2);
  end
[E(i),k] = min(abs(R));
 e(i) = [E(i)-((a+b)/2)*(2+sqrt(3))*sqrt(3)-c];                    (6)
  drawnow;
   end
 figure;
 plot(e (1:90));
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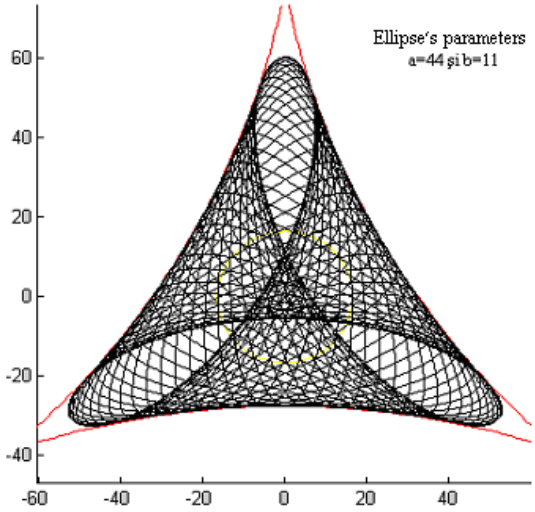

Fig.3. Representation of the rotation by ellipse with parameters a=44 [mm], b=11 [mm], Inside of curvilinear triangle

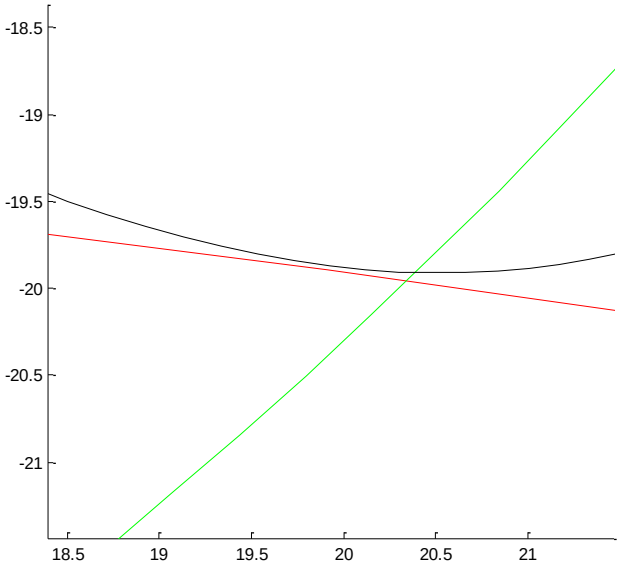

Fig.4. Detail gowned in zone of the stake reduced now at 0, 1 [mm]

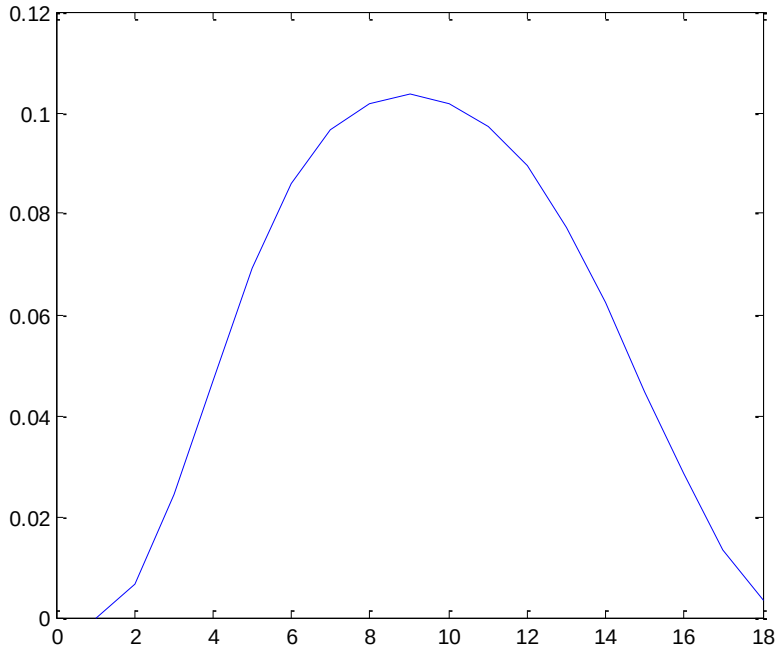

Fig.5. The diagram of the stake between elliptic piston and volumetrically chamber with parameters a=44 [mm], b=11 [mm]. This stake is 0, 1 [mm]

The parameters equations of the three circles from relations (7, 8 and 9), are reestablished by growing up the radius of circles volumetric chamber by coefficient c = r1 = (a+b)/2, and we can adjusting delicate with one positive value *p*, with reduce mother the stake between elliptic piston
and volumetrically chamber.

$$C_1:\begin{cases} x=\frac{\sqrt{3}}{2}(a+b)\left(2+\sqrt{3}\right)+(c+p)\frac{\sqrt{3}}{2}+\left(R+c+p\right)\cos\theta \\ y=(a+b)\left(2+\sqrt{3}\right)\frac{1}{2}+(c+p)\frac{1}{2}+\left(R+c+p\right)\sin\theta \end{cases} \quad (7)$$

$$C_2:\begin{cases} x=-\frac{\sqrt{3}}{2}(a+b)\left(2+\sqrt{3}\right)-(c+p)\frac{\sqrt{3}}{2}+\left(R+c+p\right)\cos\theta \\ y=(a+b)\left(2+\sqrt{3}\right)\frac{1}{2}+(c+p)\frac{1}{2}+\left(R+c+p\right)\sin\theta \end{cases} \quad (8)$$

$$C_3:\begin{cases} x=\left(R+c+p\right)\cos\theta \\ y=-(a+b)\left(2+\sqrt{3}\right)-c-p+\left(R+c+p\right)\sin\theta \end{cases} \quad (9)$$

By this modifications with Module MATLAB, is obtaining animate movement, and from diagram (fig.6) for ellipse with the parameters *a* = 28 [*mm*], *b* = 9 [*mm*] and the parameter
c = r1+3 = (a+b)/2+3 [*mm*], is obtaining one maximum stake *j* = 0,025 [*mm*].

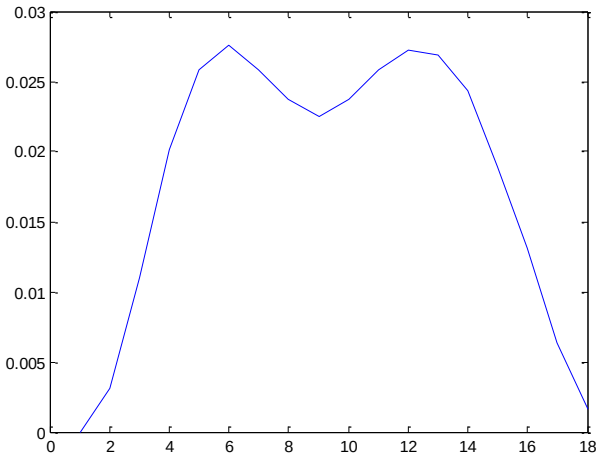

Fig. 6. The diagram with stake between ellipse with a = 28 [mm] , b = 9 [mm] and arcs of volumetric chamber , c = r1+3=(a+b)/2+3, [mm].

By growing up de parameter for correction, in MATLAB soft, *c = r1+p* , we can obtaining one good stake for good lubrication.

References

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