SYNTHESIS OF A MECHANISM THAT GENERATES THE "GLISETTE" CURVE

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ABSTRACT: Based on a geometric construction [Ferreol] and its animation, a mechanism that can generate the glisette curve is conceived. The geometric synthesis of the mechanism and its structural and kinematic analysis is made, obtaining the desired curve as a trajectory of a point on this mechanism. It is found that there is a dead point in the working of the mechanism when two sliders become parallel, which in practice is solved by the inertia of the mechanism. Other curves obtained by modifying some dimensions of the mechanism are drawn.

KEY WORDS : glisette curve, glisette generator mechanism

1. INTRODUCTION

In [1] it is presented the construction of the "glisette" curve by using Newton 's echer, as in Figure 1.

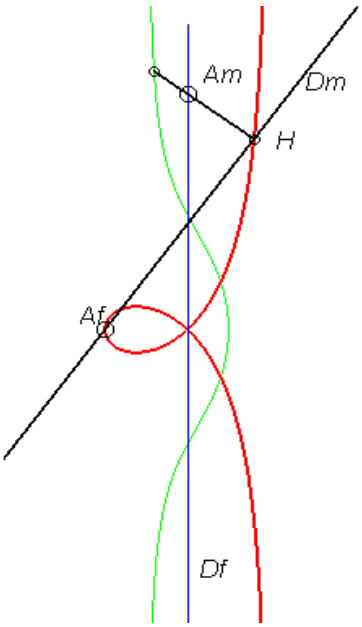

Figure 1. Glisette Generation [1]

By a fixed point A_f passes a movable straight line D_m and the point A_m belonging to the movable straight line slides on the fixed straight line D_f. During the movement the H point will describe the glisette curve. It is necessary that the distance from A_m to the movable straight lineto be equal to the distance from A_f to the fixed straight line. In [2] mathematical relations are given for this curve, and other curves are built from it.

Below is a synthesis of a mechanism that generates this curve, using the detailed methods in [3, 4]. The analysis of the position of the mechanism and the generation of the trajectories was made using the methods given in [5,6].

2. SYNTHESIS OF THE GENERATOR MECHANISM

Based on figure 1, and its animation given in [2], the synthesis of the generating mechanism is given in figure 2.

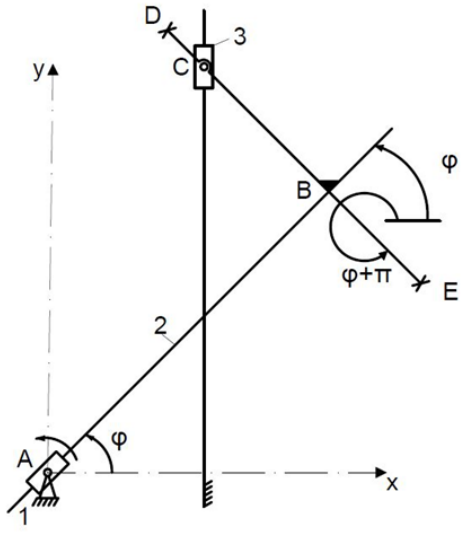

Figure 2. The generating mechanism

Newton's quote is ABC. The fixed point is A, and the movable straight line has a variable length so that an oscillatory slide is mounted in A. Point C slides on the fixed straight line parallel to the ordinate, which passes through C, so that a slider is mounted here too. It is necessary that x_C = BC. Point B will draw the slider.In order to obtain several curves, the BC element was extended to E and D.

3. MECHANISM ANALYSIS

The structure of the mechanism is shown in Figure 3, which is composed of a rotating driving element (slider 1) and a PRP dyad.

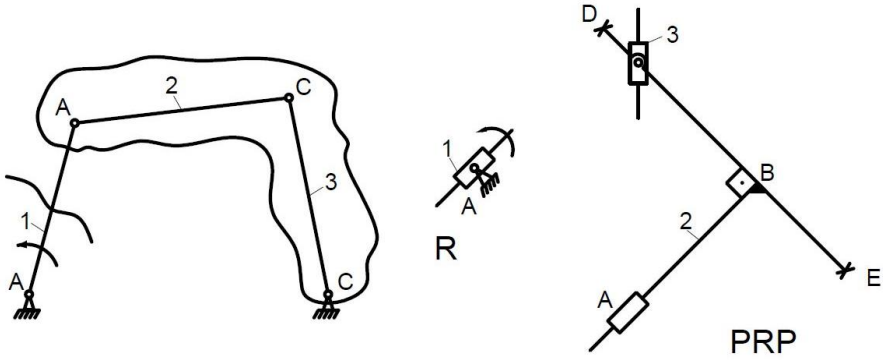

Figure 3. Structure of the mechanism

Based on figure 2 the following equations are written:

$$x_C = const. \quad (1)$$

$$AB\cos\varphi + BC\cos(\varphi + 90) = x_C \quad (2)$$

$$AB\sin\varphi + BC\sin(\varphi + 90) = y_C \quad (3)$$

$$BC = x_C \quad (4)$$

$$x_B = AB\cos\varphi \quad (5)$$

$$y_B = AB\sin\varphi \quad (6)$$

$$x_D = x_B + BD\cos(\varphi + 90) \quad (7)$$

$$y_D = y_B + BD\sin(\varphi + 90) \quad (8)$$

$$x_E = x_B + BE\cos(\varphi + \pi) \quad (9)$$

$$y_E = y_B + BE\sin(\varphi + \pi) \quad (10)$$

From these relationships we determine AB and y_C , then the coordinates of points B, D and E. We took: x_C =20, BD = ED = 35 mm.

4. RESULTS

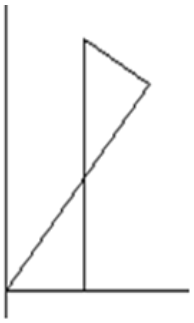

Figure 4 shows the resulting mechanism in one position, and in Figure 5are shown the successive positions of the mechanism. The glisette generated is shown in Figure 6.

Figure 4. Mechanism in one position

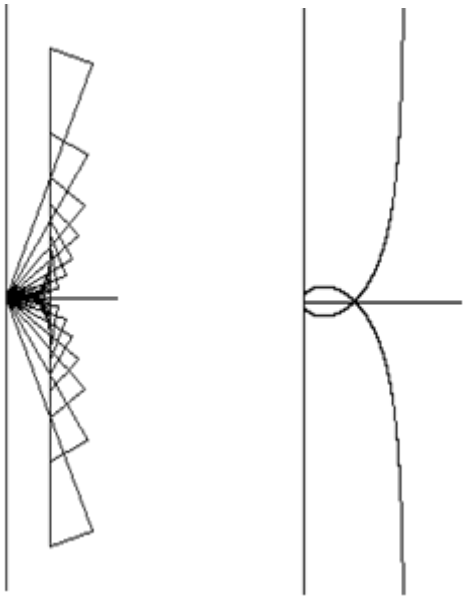

Figure 5. Figure 6. Glisetta generated The mechanism in successive positions

Figure 7 shows that the mechanism does not work for φ = 78 ... 102 degrees, the sliders 1 and 3 becoming parallel. The actual operation goes through this subinterval due to the inertia of the mechanism.

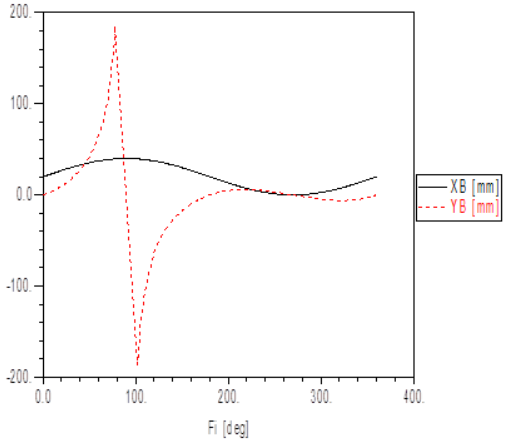

Fig. 7. Variation of the coordinates of the tracer point

The strokes AB and y_C have the variations given in Figure 8, the curves overlapping at the ends.

The curves drawn by B and D are shown in Figure 9 and those for B and E in Figure 10.

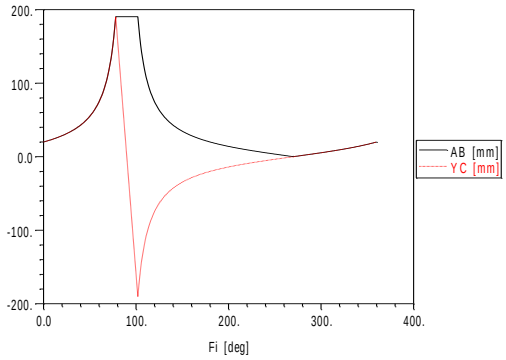

Fig. 8. Variation of strokes AB and Y_C.

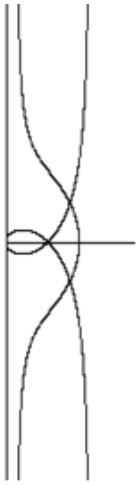

Fig. 9.Curves for B and D

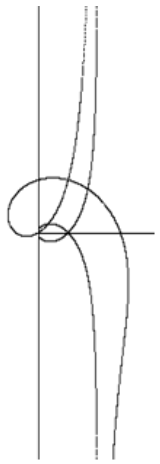

Fig. 10. Curves for B and E.

5. OUTPUT CURVES FOR MODIFIED DATA

To begin with, it has not met the condition x_C=BC, yielding more curves drawn by the point B given below. (fig.11…16).

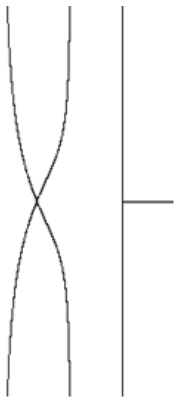

Fig. 11. x_C = -50

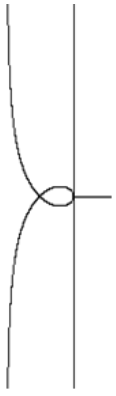

Fig. 12. x_C = -20

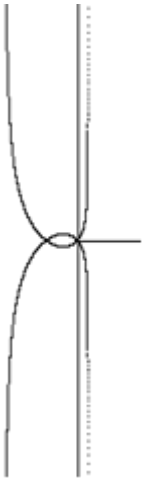

Fig. 13. $x_C = -15$

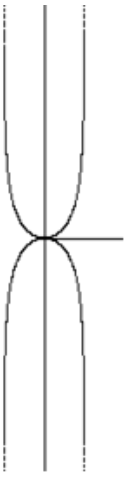

Fig. 14. $x_C = 0$

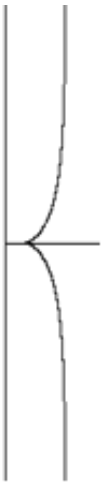

Fig. 18. BD = 10

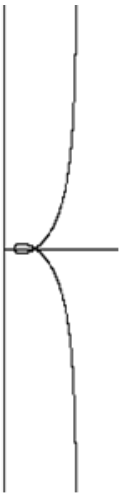

Fig. 19. BD = 5

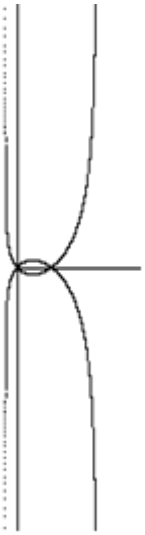

Fig. 15. $x_C = 15$

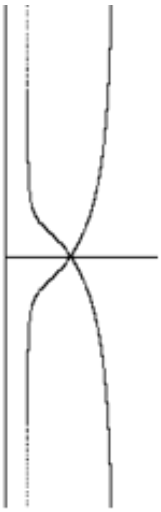

Fig. 16. $x_C = 30$

Fig. 20. BD = 15

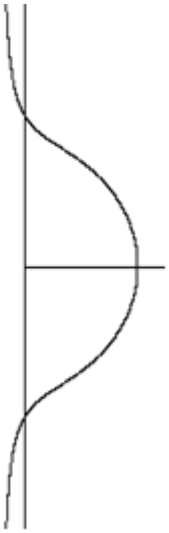

Fig. 21. BD = 50

Different glisette curves resulted. Further on it is kept x_C = BC, changing x_C , BD and BE (fig. 18…24).

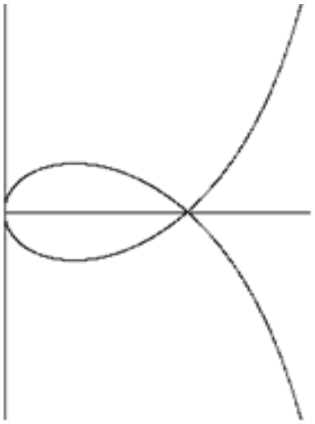

Fig. 17. $x_C = 90$

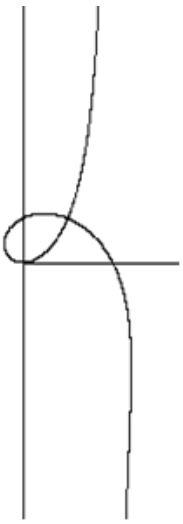

Fig. 22. BE = 20

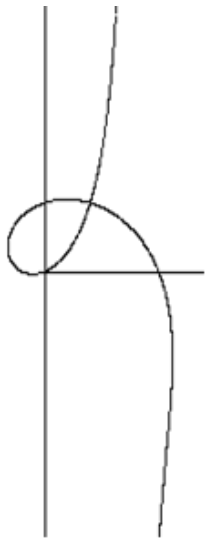

Fig. 23. BE = 30

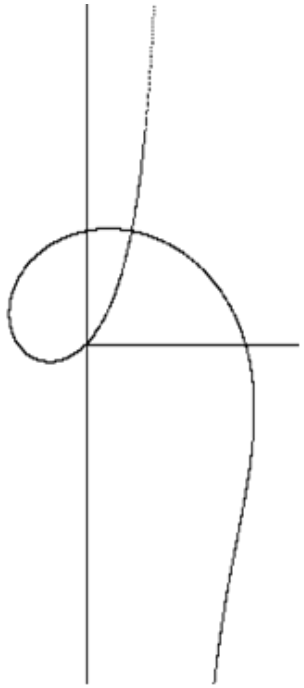

Fig. 24. BE = 50

The curves are similar to the glisette but are positioned differently and are deformed.

6. CONCLUSION

It startedwith the geometric generation of the glisette and the geometric synthesis of a generator mechanism was made. It has been shown that this mechanism generates this curve. In operation of the mechanism there is a pause when the two sliders become almost parallel, but in a real case it passes through this dead point position due to the inertia of the mechanism. The dimensions of the mechanism have been changed resulting in other curves if an initial condition is not met, or, respecting the initial conditions, other dimensions have been changed, resulting in glisette positioned in different places relative to the axissystemor deformedcurves.

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