CURVES AND AESTHETIC SURFACES GENERATED BY THE R-R-RTR MECHANISM

Professor Ph.D. Liliana **LUCA**
Faculty of Engineering, University Constantin Brancusi of Targu-Jiu, Targu-Jiu, Romania,
lylyanaluca@yahoo.com
Professor Ph.D. Iulian **POPESCU**
Faculty of Mechanical, University of Craiova, Craiova, Romania,
rodicaipopescu@yahoo.com

Abstract. *Let's consider a mechanism having two driving elements with revolving movements and a RTR dyad, with elements of null length and aesthetic tracks of a point are determined on a rod, for various linear movement laws of driving elements. The generated curves revolve around x and y axes and aesthetic surfaces result.*

Key words: mechanisms tracks, mechanism aesthetics, two driving elements.

1. INTRODUCTION

The literature studies various mechanisms having their mobility level equal to 1. Paths, movement laws, successive positions are determined. In very few cases, M=2 mechanisms are analysed. [1] studies the paths generated by a space mechanisms with two conducting elements, that is two rotations after perpendicular directions. There is evidence for the possibility of using this mechanism in the researches of the cosmic space. In [2] a mechanism for a press is optimized starting from its geometry and the kinematic study, then by using the Adams soft. In [3] kinematic and dynamic studies are made at a walking mechanism used for human prostheses. Interest points paths and successive positions of the final conducted elements are studied. In [4] the moving biologic mechanisms of some insects are studied reaching equivalent mechanisms, building robots with various freedom levels. In [5] there are structural and kinematic problems of mechanisms that generate aesthetic surfaces. Such curves and surfaces are useful for: kinetic art, commercials, artesian fountains, toys etc.

2. KINEMATIC SCHEME

Fig. 1 indicates the kinematic scheme of this mechanism. It consists of the revolving driving elements 1 and 4 and RTR 2-3 dyad. The length of the BC rod is variable during the movement. The tracks of the E point located at the maximum length of the BC rod with a variable length have to be determined.

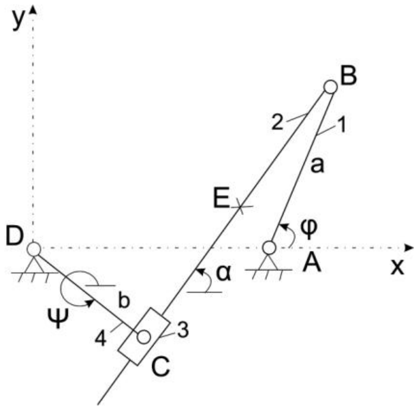

Fig. 1

3. RESULTING AESTHETIC CURVES.

The following sizes of the mechanism were adopted: a=30; b=50; BE=25 ; x_A= variable. The movement laws of the driving elements were considered correlated through the relation: $\varphi = c\psi$. ψ =0…was cycled for 360 degrees and φ was determined using the above relation, therefore for every value of ψ there is a different value of φ. Many of the curves generated by this mechanism are given in another paper. Only some aesthetic curves are given here. Some of the next figures comprise the system of axes from fig. 1. Fig. 2 indicates a curve resulted for c= -1, XA=25. The curve from fig. 3 resulted for c=2, XA=25.

For c=2 and XA=80 there is the curve from fig. 4, and for c= - 2 and XA=25 there is the curve in fig. 5.

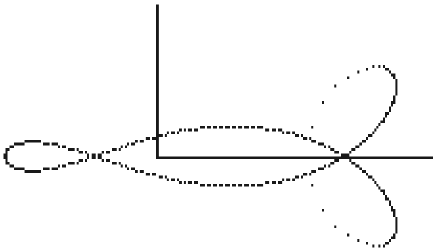
Fig. 2

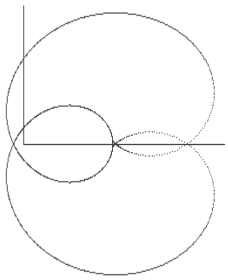
Fig. 3

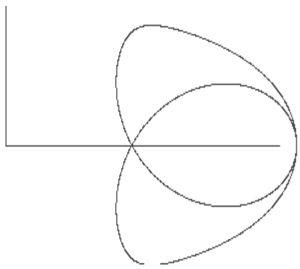
Fig. 4

Working similarly, other curves resulted:

- fig. 6 for c=3, XA=25;
- fig. 7 for c=3, XA=80;
- fig. 8 for c= - 3, XA=25;
- fig. 9 for c=10, XA=1;
- fig. 10 for c= - 10,XA=1;

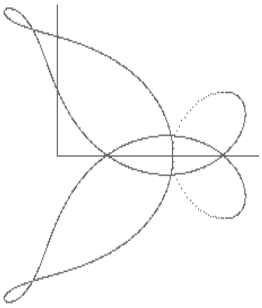

Fig. 5

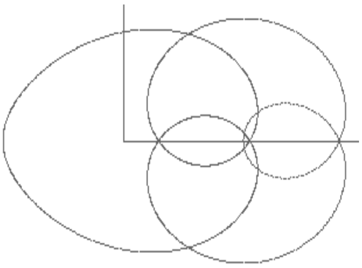

Fig. 6

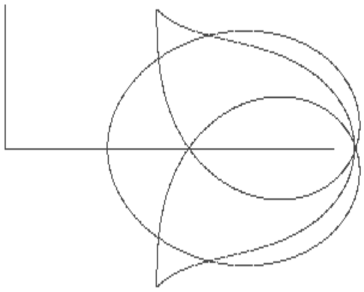

Fig. 7

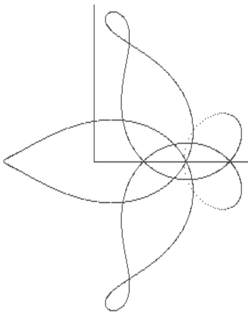

Fig. 8

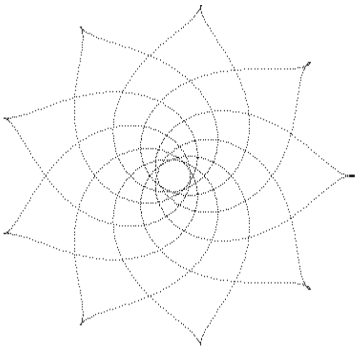

Fig. 9

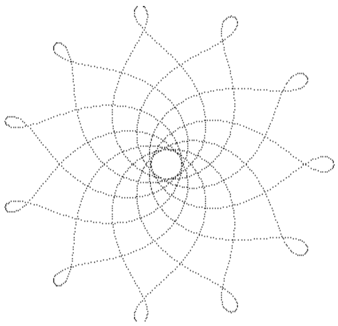

Fig. 10

- fig. 11 for c=10, XA=10;
- fig. 12 for c= 10, XA=50;
- fig. 13 for c= - 10, XA=50;
- fig. 14 for c= 5, XA=50;
- fig. 15 for c= 20, XA=10.

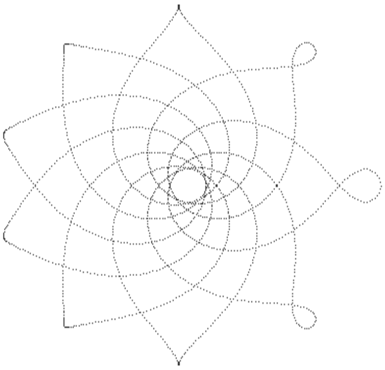

Fig. 11

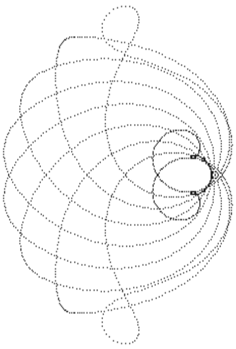

Fig. 12

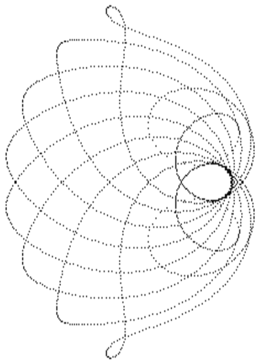

Fig. 13

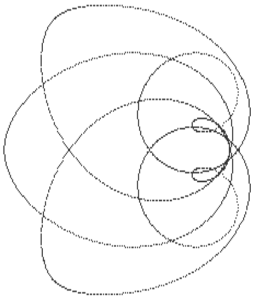

Fig. 14

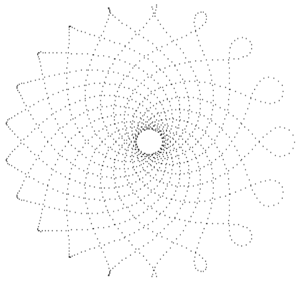

Fig. 15

These curves have special aesthetics.

4. RESULTED AESTHETIC SURFACES

The above curves were rotated together with other curves around x and y axes, and surfaces resulted rendered here through the projections in xoy plan. These surfaces have special aesthetics. ψ =0…was cycled for 360 degrees and φ was determined using the above relation, therefore for every value of ψ there is another value of φ. For every value of ψ a trajectory results, the resulting surface being a succession of trajectories.

Therefore, for the track in fig. 16 (c=1, XA=25), there is the surface from fig. 17 at its revolution around x and the one in fig. 18 at its revolution around y.

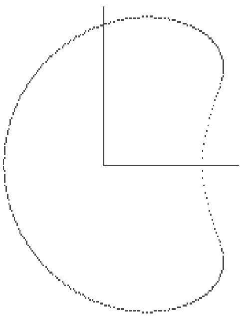

Fig. 16

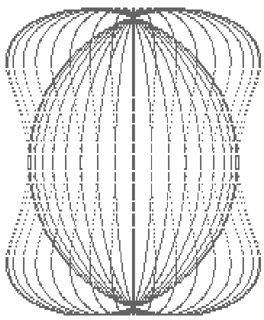

Fig. 17

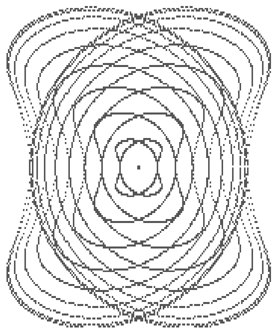

Fig. 18

For the curve in fig. 2, there is the surface in fig. 19 at its revolution around x and the one in fig. 20 at its revolution around y.

The curve in fig. 21 (c=1, XA=80) provides the surface in fig. 22 at the revolution around x and the one in fig. 23 at the revolution around y.

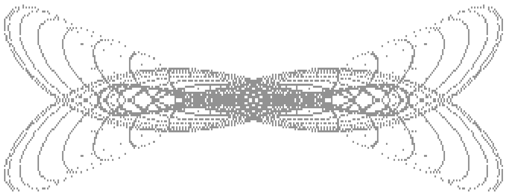

Fig. 19

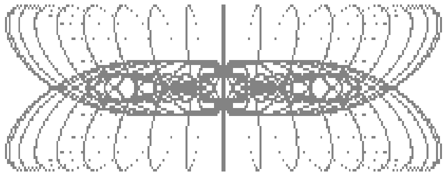

Fig. 20

The curve in fig. 21 (c=1, XA=80) provides the surface in fig. 22 at the revolution around x and the one in fig. 23 at the revolution around y.

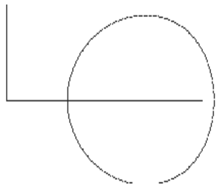

Fig. 21

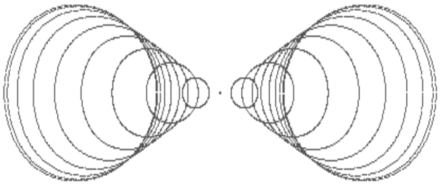

Fig. 22

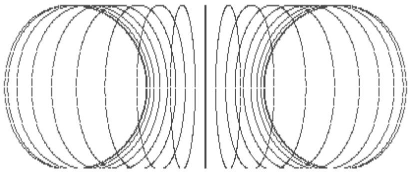

Fig. 23

For the curve in fig. 24 (c=0,1, XA=25), there is he surface in fig. 25, at its revolution around x and that in fig. 26 at the revolution around y.

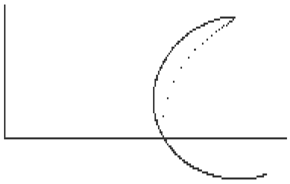

Fig. 24

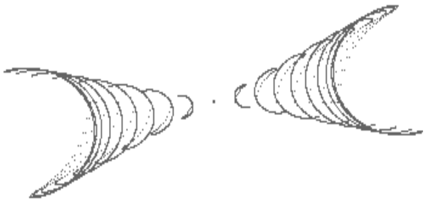

Fig. 25

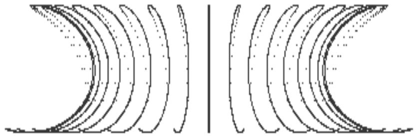

Fig. 26

The curve in fig. 27 (c= - 0,1, XA=25) provides the surface in fig. 28 at the revolution around x and that in fig. 29 at the revolution around y.

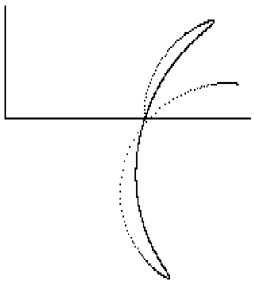

Fig. 27

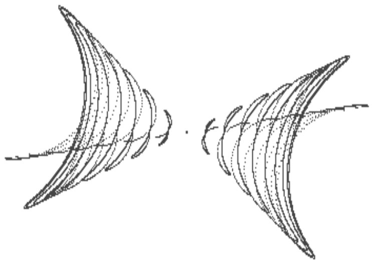

Fig. 28

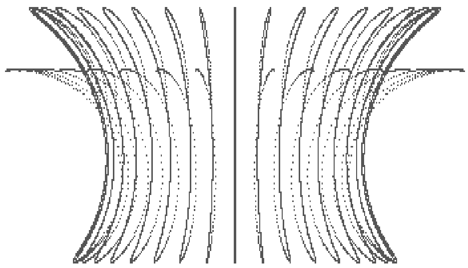

Fig. 29

For the curve in fig. 3 (c=3, XA=25) there is the surface in fig. 30 at the revolution around x and that in fig. 31 at the revolution around y.

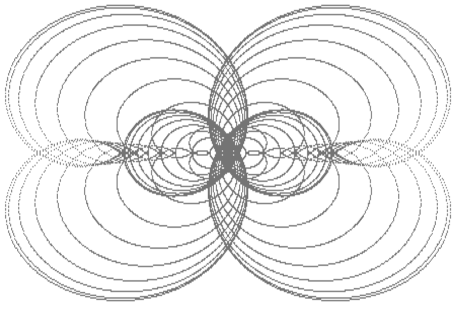

Fig. 30

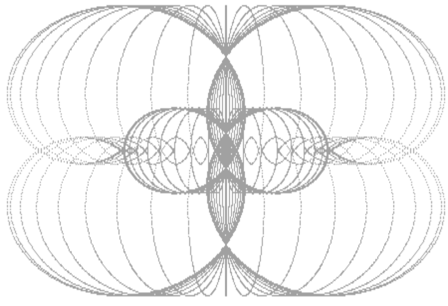

Fig. 31

Similarly, for the curve in fig. 4 (c=2, XA=80), there are fig. 32 (at the revolution around x) and fig. 33 (at the revolution around y).

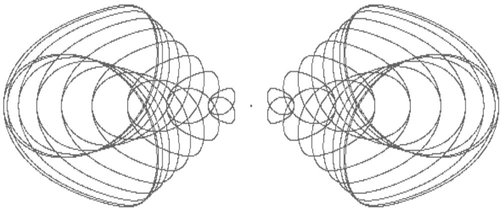

Fig. 32

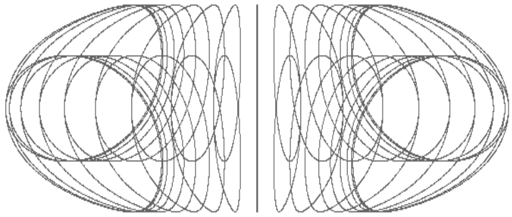

Fig. 33

Similarly, the curve in fig. 5 (c= - 2, XA=25) provides the surface in fig. 34 and 35.

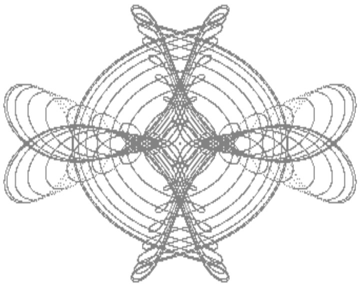

Fig. 34

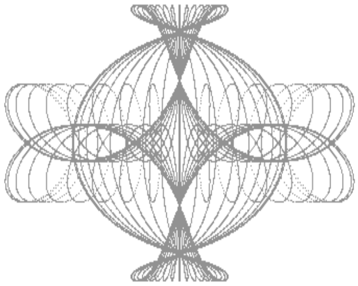

Fig. 35

The curve in fig. 36 (c= - 2, XA=80) provides the surfaces from fig. 37 and 38.

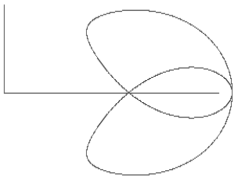

Fig. 36

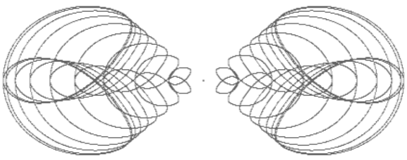

Fig. 37

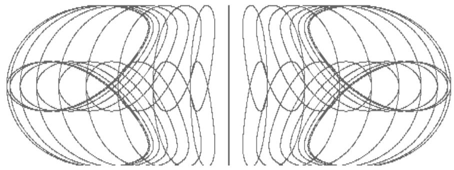

Fig. 38

The curve in fig. 6 (c=3, XA=25) provides the surface from fig. 39 and 40.
Similarly, the curve from fig. 7 (c=3, XA=80) generates the surface from fig. 41 and 42.

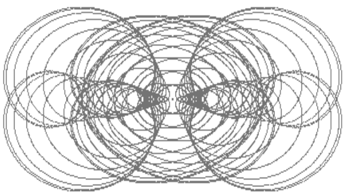

Fig. 39

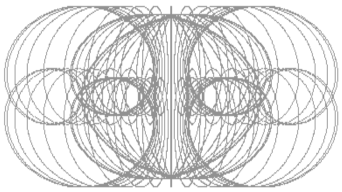

Fig. 40

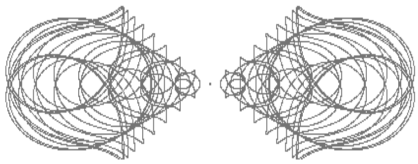

Fig. 41

The curve in fig. 8 (c= - 3, XA=25) generated the surface from fig. 43 and 44.

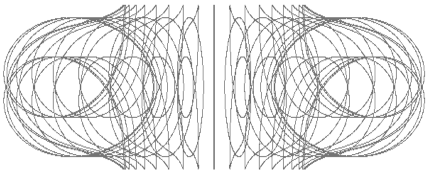

Fig. 42

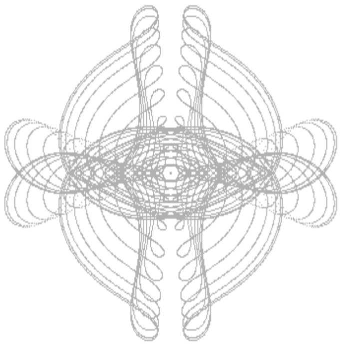

Fig. 43

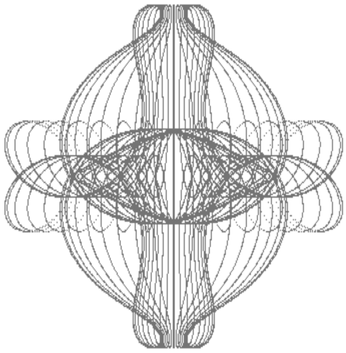

Fig. 44

All these surfaces have special aesthetics.

5. CONCLUSIONS

- the studied mechanism provides aesthetic curves for some dimensions and linear correlations between the movement laws of the two driving elements.

- the resulted aesthetic curves provide the aesthetic curves at the revolution around x and y axes.

- some curves without special aesthetics result in aesthetic surfaces as well.

REFERENCES

[1].Provatidis, C., Tsiriggakis, V. – *A new concept and design aspects of an antigravity propulsion mechanism based on inertial forces*. http://energythic.com/view.php?node=212

[2].Wen-Hsiang Hsieh, Chia-Heng Tsai - On a novel press system with six links for precision deep drawing. În: *Mechanism and Machine Theory* (01 November 2010)

[3].Jin, D. ş. a. - *Kinematic and dynamic performance of prosthetic knee joint using six-bar mechanism.* În: JRRD, Volume 40 Number 1, 2003 Pages 39 — 48.

[4].Quinn, R.D. ş. a. - *Insect Designs for Improved Robot Mobility*. În: Proc. 4th Int. Conf. On Climbing and Walking Robots, Berns and Dillmann eds., Prof. Eng. Pub., 69-76, 2001. [http://biorobots.cwru.edu/publications/clawar01mobility.pdf]

[5].Popescu Iulian – *Structura şi cinematica unor mecanisme generatoare de curbe şi suprafețe estetice*, Editura Sitech, Craiova, 2012.

[6].Popescu Iulian - *Mecanisme. Noi algoritmi şi programe*. Reprografia Universității din Craiova, 1997.

[7].Popescu I., Luca, L., Cherciu, M. – *Traiectorii şi legi de mişcare ale unor mecanisme*, Editura Sitech, Craiova, 2011.

[8].Teodorescu, I. D., Teodorescu, Şt.D. – *Culegere de probleme de geometrie superioară*, Editura Didactică şi Pedagogică, Bucureşti, 1975