THE ANALYSIS OF PLANE QUADRILATERAL MECHANISMS REGARDING THE ROD CURVES

LAZĂR Mircea
University of Piteşti
mircea@lzr.ro

Keywords: *rod curve, parametric equations, mechanism*

As we know, the rod curve is the geometrical position described by a point of the rod plane. In the case of the articulated plane quadrilateral mechanism [2] the rod curve is a sixth degree cyclic curve and the infinity cyclic points through which the curve passes are triple points. In this work, starting from the parametrical equations of the rod curve, we point out some new features of this curve. First of all we determine the implicit equation of the rod curve. We consider a reference system XOY, the quadrilateral mechanism A_0ABB_0 (fig. 1), where $A_0B_0 = d$; $A_0A = a$; $AB = b$; $B_0B = c$, and M is a point of the rod plane so that $MA = e$; $MB = f$; $\angle AMB = \alpha$. We trace the vectorial relations, $\overline{OM} = \overline{OA_0} + \overline{A_0A} + \overline{AM} = \overline{OB_O} + \overline{B_OB} + \overline{BM}$, on the axes of the reference system and by taking into account the notations in figure 1 and the various notations, we obtain the implicit equation of the rod curve: $U^2 + V^2 - W^2 = 0$;

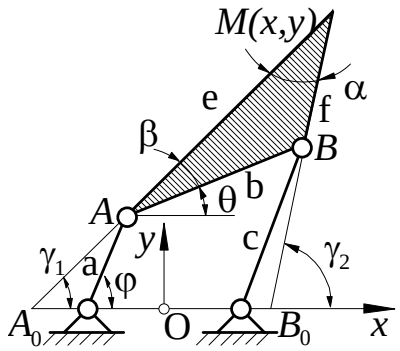

Fig. 1

After the implicit equation we determine the parametrical equations of the rod curve. By tracing the vectorial relation, $\overline{A_0A} + \overline{AB} + \overline{BB_0} - \overline{A_0B_0} = 0$, on the axes of the reference system *OXY* , and by taking into account the notations in figure 1, we obtain the parametric equations of the rod curve, function of the *angle* φ:

$$x = -\frac{d}{2} + a\cos\varphi + e\cos(\theta + \beta)\,;\quad y = a\sin\varphi + e\sin(\theta + \beta)\,.$$

Based on the implicit equation of the rod curve and on the parametric equations of the rod curve we obtain the general properties of the rod curve: *The rod curve has two branches, If M is a point situated on the rod then the two branches of the rod are symmetrical or the perpendicular lines on axis* A_0B_0 *of the fixed articulations, intersects the rod curve in at most four points, two by two are symmetrical to the axis* A_0B_0 and some general aspects of Roberts' triple generation. All the characteristics and aspects of Roberts' triple generation are exemplified in the paper by different mechanisms. Some characteristics of the rod curve pointed out in the work in connection with the characteristics which come out of Roberts' theorem give new possibilities for the synthesis of trajectory generating mechanisms.

REFERENCES

[1] Artobolevsky I., *Mechanismes in modern engineering design*, Vol. 1, Mir Publishers Moscow, 1975.
[2] Manolescu N., Kovacs Fr., Oranescu A., *Teoria mecanismelor şi a maşinilor*. Editura Didactică si Pedagogică, Bucureşti, 1972 .
[3]. Pandrea N., Lazăr M., *Asupra sintezei mecanismelor plane cu ajutorul curbei de bielă.* Buletin ştiintific al Universității Piteşti, Seria Mecanică, nr. 1, 1996.