ALGORITHM OF DEDUCING KNIFE TRANSLATION MOTION COURSE FOR MANUAL TEXTIL CUTTING MACHINE

Claudia VIRAGOS-TOTH[a]
[a] "TRANSILVANIA" University of Brasov, Department of Product Design and Robotics,
e-mail: Claudia_Viragos@unitbv.ro

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Abstract: The mechanism is defined as the technical system, which works as an independent system or subsystem of a more complex system called machine. As an independent system, mechanism can be manually driven (bio-mechanic for example) or directly driven by electric forces (electromotor for example). From the mechanic point of view, mechanism is the technical system / subsystem which transform and transmits, from input to output, a certain rotation / translation movement, under the action of some force / moment.

1. CONSTRUCTIVE SCHEMA

A constructive schema is a simplified representation of geometrical shape of kinematics elements and pairs in orthogonal or perspective projection. In figure 1 is represents the constructive schema of manual textile cutting machine. The system has one input (rotation motion given from electrical motor 1) and two outputs: one is knife section witch have a translation motion 3, the second is ragged plate 2 whose motion is give through quadrilateral mechanism entrainment [2].

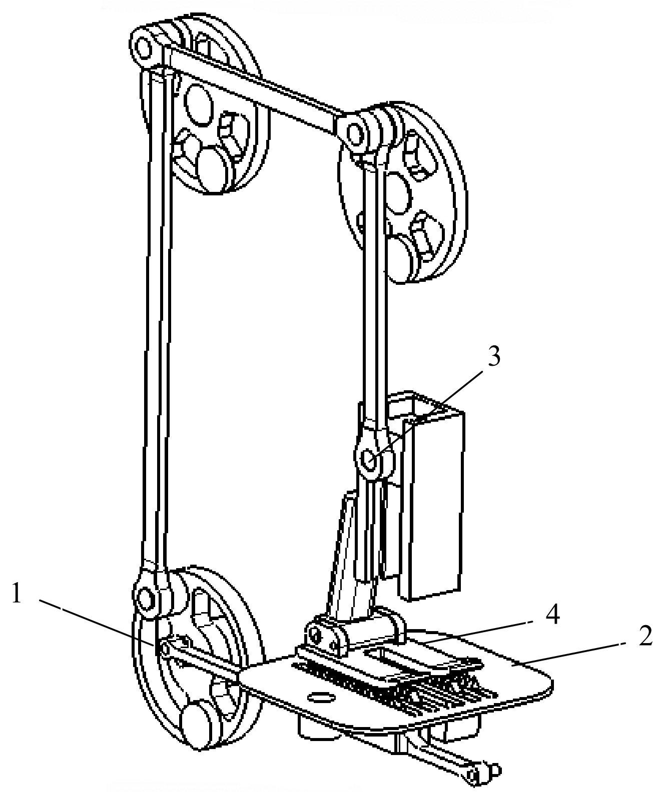

Fig. 1. The constructive schema of manual textile cutting machine.

The system of fixing / driving is format from press bend 4 and ragged plate. The last one is who drive the textile material from knife section to backward and his motion is define from quadrilateral mechanism. By reason of this motion for user is not necessary to approach too much from the knife section for holding the material.

2. MECHANICAL (KINEMATIC) SCHEMA OF JOINTED TRANSMISSION MACHINE

A mechanical or kinematical schema is the synthetic representation of kinematical elements, kinematical pairs and of the planar and spatial mechanism, which signifies the specific geometrical configuration of kinematical elements and kinematical pairs in the direction of movement transmission from the input to the output of mechanism.

The solution has three quadrilateral mechanism (ABGD, DIHG, EIJF) witches help the electrical motor to transmit his motion to output and one slider crank mechanism (ABC). It is a simple mechanism whose motion is in one plane figure.2.

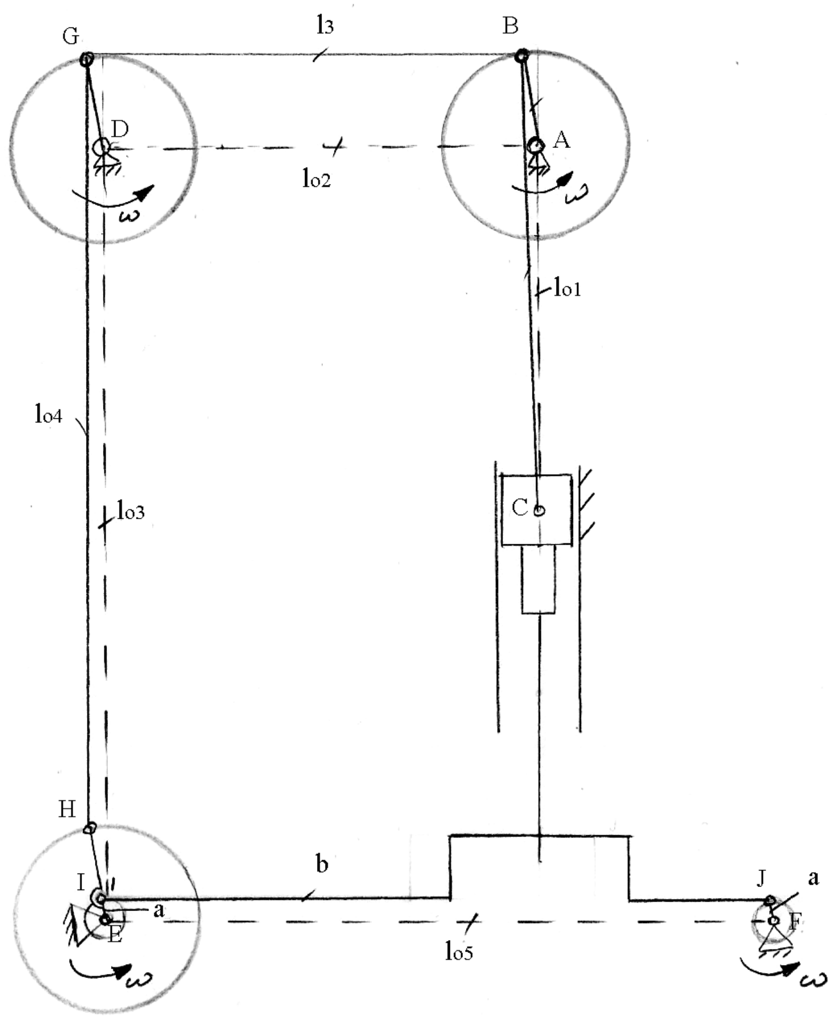

Fig. 2. Kinematical schema of manual textile cutting machine.

Electrical motor is placed in bottom part of machine, E, and he drive directly the quadrilateral mechanism. The ω is angular speed. The ragged plate (b) motion is give from quadrilateral mechanism entrainment EIJF.

3. THE CRANK SLIDER MECHANISM

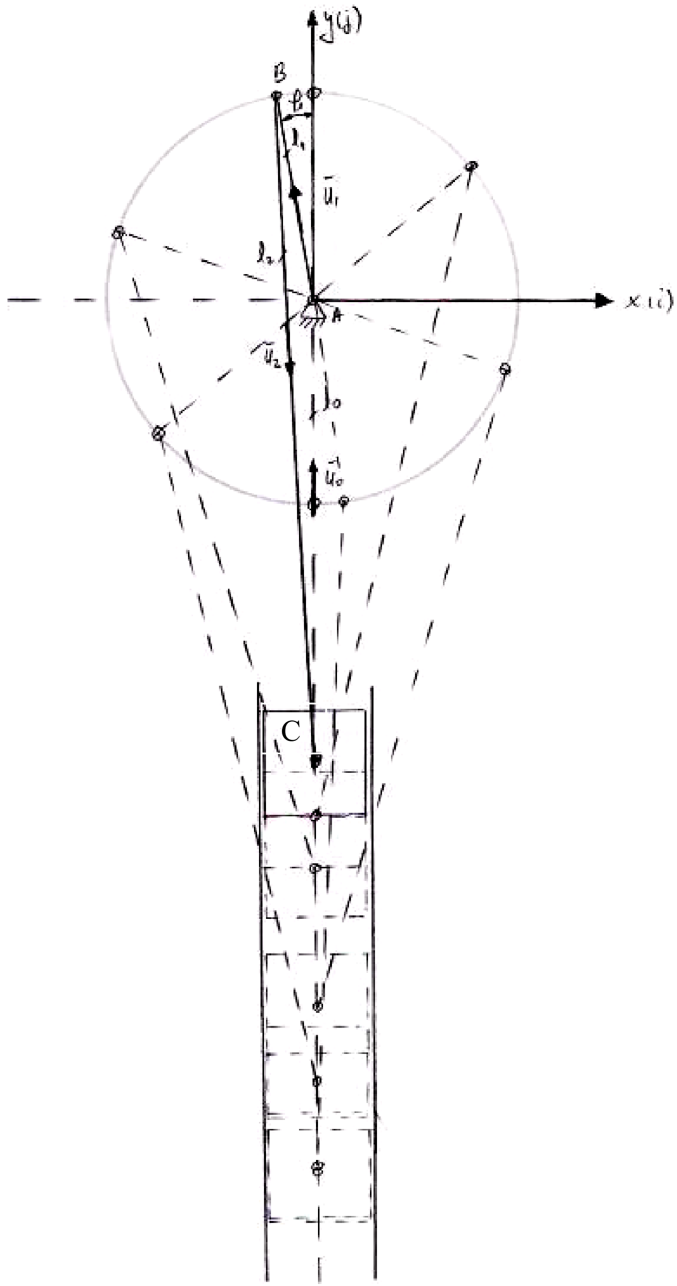

Fig. 3. The six's position of movements.

Where: l_1- crank; B-bolt; l_2- driving rod; C- slide plate.
Geometrical parameters: $\varphi_1=10^o$; l_1=20mm; l_2=65mm; l_{0min}=45mm=S (knife course)
The parametric equation of the contour ABCA [4]:

$$\bar{u}_0=\bar{j} \tag{1}$$

$$\bar{u}_1=-\bar{i}\cdot\sin\varphi_1+\bar{j}\cdot\cos\varphi_1 \tag{2}$$

$$\bar{u}_2=\bar{i}\cdot\sin\varphi_2-\bar{j}\cdot\cos\varphi_2 \tag{3}$$

The contour equation:

$$\Sigma l_k\cdot\bar{u}_k=0 \tag{4}$$

$$l_0 * \bar{u}_0 + l_1 * \bar{u}_1 + l_2 * \bar{u}_2 = 0 \quad (5)$$
$$l_0^2 + l_1^2 - l_2^2 + 2 * l_0 * l_1 * \bar{u}_0 * \bar{u}_1 = 0 \quad (6)$$
$$S^2 + 400 - 4225 + 40 * \cos \varphi_1 = 0 \quad (7)$$
$$S^2 + 40 * S * \cos \varphi_1 - 3825 = 0 \quad (8)$$

It's proposing six position of movement. The B point describe a circle and define the six's position of movements. The first position (also, the initial position) is when point B has φ_1=10º. φ_1 angle is increment with 60º, so, we have φ_1=10º, 70º, 130º, 190º, 250º, 310º.

$$S_1 = -20 * \cos \varphi_1 + \sqrt{400 * \cos \varphi 1 * \cos \varphi 1 + 3825} \quad (9)$$
$$\varphi_1 = 10^o \Rightarrow S_1 = -19,69 + 64,907 = 45,21mm \quad (10)$$
$$\varphi_1 = 70^o \Rightarrow S_1 = -6,84 + 62,223 = 55,38mm \quad (11)$$
$$\varphi_1 = 130^o \Rightarrow S_1 = 12,85 + 63,168 = 76,018mm \quad (12)$$
$$\varphi_1 = 190^o \Rightarrow S_1 == 19,696 + 64,907 = 84,603mm \quad (13)$$
$$\varphi_1 = 250^o \Rightarrow S_1 = 6,84 + 62,223 = 69,063mm \quad (14)$$
$$\varphi_1 = 310^o \Rightarrow S_1 = -12,85 + 63,168 = 50,312mm \quad (15)$$

The minim value of course is φ_1=0º, and is the upper position of knife on vertical axis, S_{1min}= -20+65=45mm; respective the maxim value of course is φ_1=180º, and is the lower position of knife on vertical axis. S_{1max}=20+65=85mm.

So, the textile material knife cutting course is: S_{1max} - S_{1min}=85-45=40mm.

In the table 1 is values for all six knife's movement position and in figure 4 is represent the graphic of them. It is also represent the minim and maxim knife position on vertical axis.

Table 1

φ_1[º]	0	10	70	130	180	190	250	310
S_1[mm]	45	45,21	55,38	76,018	85	84,603	69,063	50,312

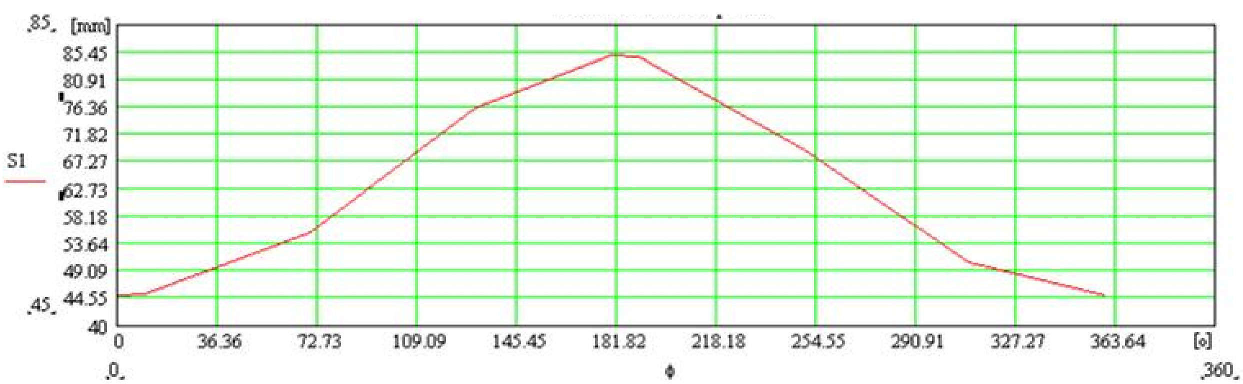

Fig. 4 Graphic of position functions

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