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STEPING ROBOT WITH FOUR FOOTS

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Abstract: The mobile robots have offered the support of impressive results in almost all areas. The foot's number is an important element and affects mostly the next proprieties: stability and energetic efficiency. The paper presents the study of a stepping robot with four foots. The actuating is realized through a motor, and the free transmission uses mechanisms quadrilateral. A controller realizes the actuation and the control. There are presented: the structural scheme of the leg, the flow chart and the attached graph of the foot, the calculus of the mobility degree of the mechanism, the constructive shape, the stepping diagram and the 3D-ensemble design of the four-foot stepping motor.

Key words: robots, stepping robot, mechanisms quadrilateral, locomotion function.

1. INTRODUCTION

The current researches are clearly oriented to the implementation of the performing robotic structures, using the new technologies, which facilitates both the mechanical part structure and the force or the intelligence.

An analysis of the researches in this area shows a clear increase of the approached subjects numbers and a clearly orientation, a research direction concentration to the most prestigious universities and research institutes.

The complexity of the animal world offers the best field for an authentic scientific research. Starting from the new obtaining composite technologies of new materials and until the control with genetic algorithm (based on the evolutionary principles), the mobile robots had offered the support of great results in almost all domains.

The area of animal world offers by its diversity the best and the perfect solutions for the implementation of a robotic structure. We just have to imitate it, appealing to the technological support that we have and to the qualitative solutions which bring us near to the animal world [3], [4].

2. THE DESIGN OF THE STEPPING ROBOT WITH FOUR FOOTS

A basis conditions, imposed as early as the design phases, is the robot stability.

The stability of the stepping robots must be studied differently:

- walking – dynamic stability;
- stationary – static stability.

The structure's diversity is very big. The most usual structures are the 2d structures.

The mechanical structures of the animals are adjusted to there necessities. the foot's number is an important element because it affects many proprieties of the stepping robot.

In figure 1 is presented the scheme of the stepping robot with four foots presented by the authors.

The robot is autonom and he has attached the locomotion system, the control system and the energy supply system**.**

The body has rectangular shape, with four legs that are fitted on each of the four edges.

The constructive shape of the leg: two liberty degrees, with vertical lifting of the leg and horizontal motion for steeping ahead and back.

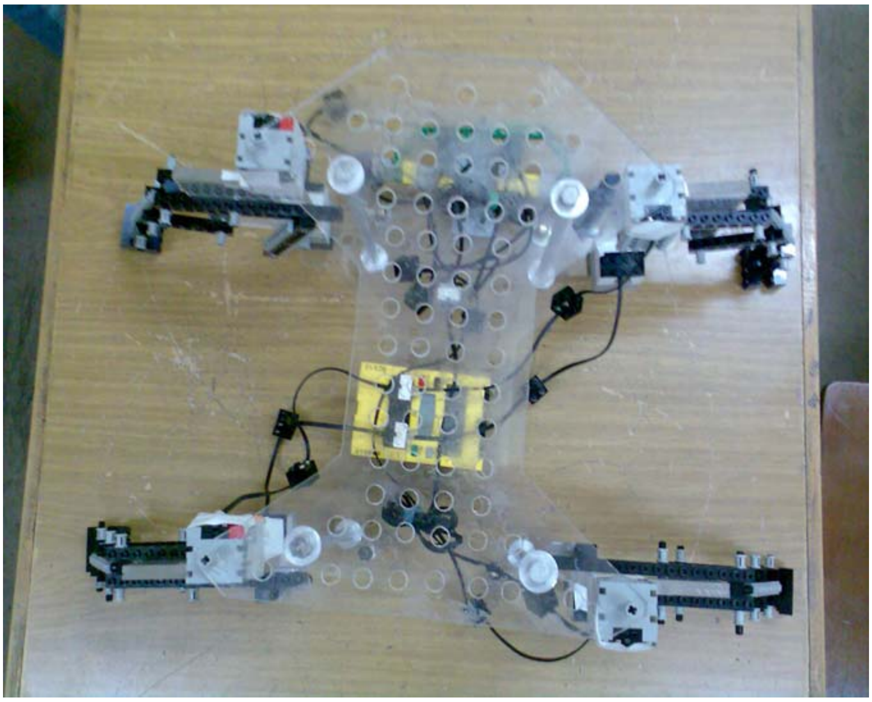


Fig.1 The scheme of the stepping robot with four foots

In figure 2 there is presented the structural scheme of the mechanism of the robot's leg.

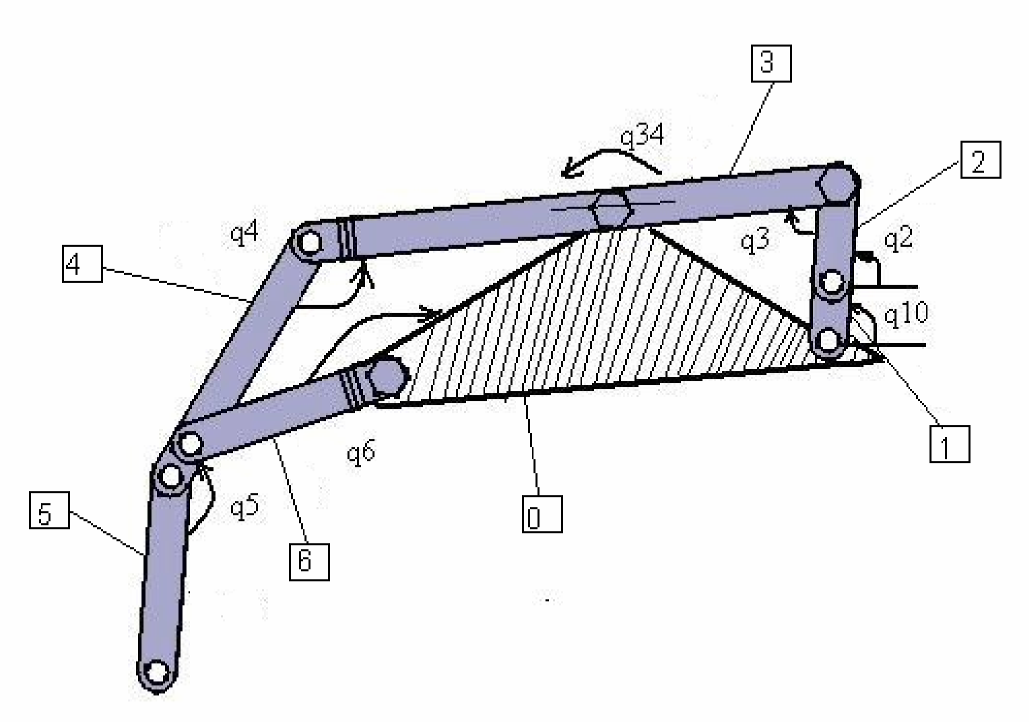


Fig.2 The structural scheme of the mechanism of the robot's leg

3. THE CALCULUS OF THE MOBILITZ DEGREE OF THE MECHANISM

Figure 3 and figure 4 presents the flow chart and respectively the associated graph of the stepping mechanism.

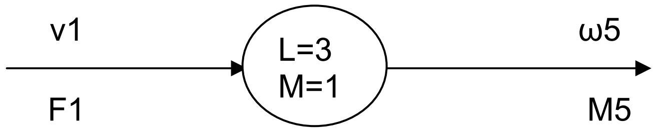


Fig. 3 The flow chart mechanism

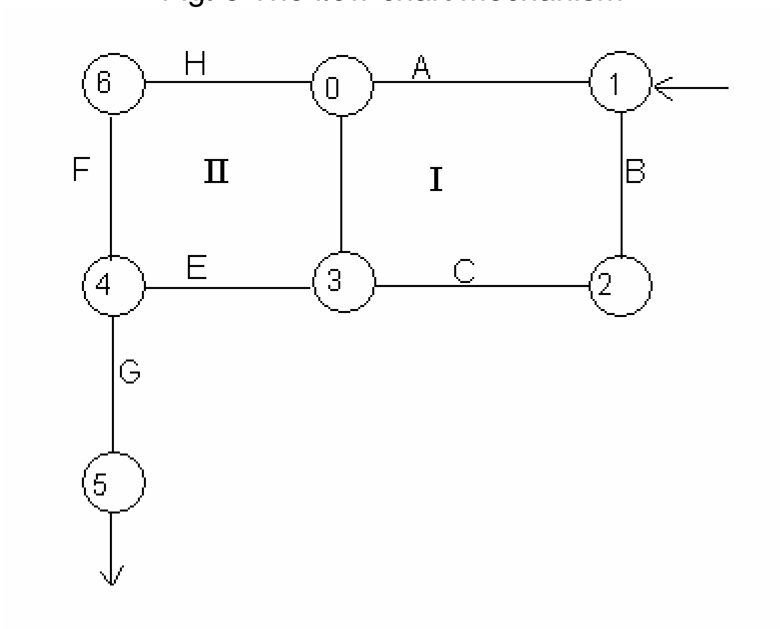


Fig. 4 The associated graph mechanism

$$M = \sum Mi - \sum Lc = M1+M2 - Lc \quad (1)$$

$$M1 = \sum fi - \lambda i = fA + fB + fC + fD - \lambda i = 1+1+1+1-3 = 4-3 = 1 \quad (2)$$

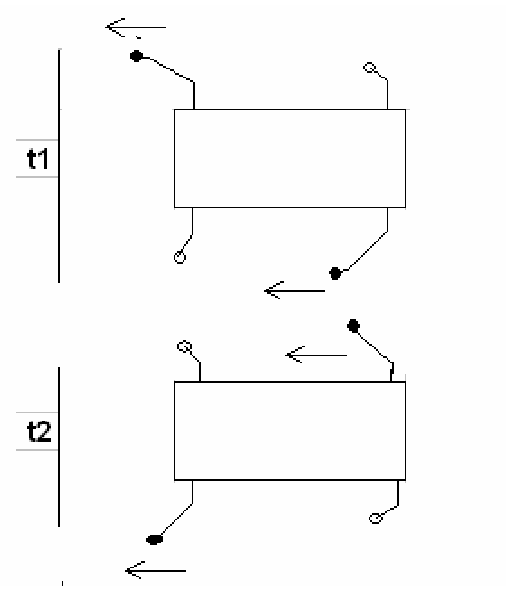
The rank of the mechanism ‘λi’ = 3

$$M2 = fD + fE + fH + fF - \lambda i = 4 - 3 = 1 \quad (3)$$

$$M = \sum Mi - \sum fc = M1+M2 - Lc = 2 - 1 = 1. \quad (4)$$

The mechanism has the first degree of mobility.

In figure 5 there is presented the stepping diagram of the robot. The stepping is realized in the periods $t_1 \ldots t_4$ corresponding the foot actuating.



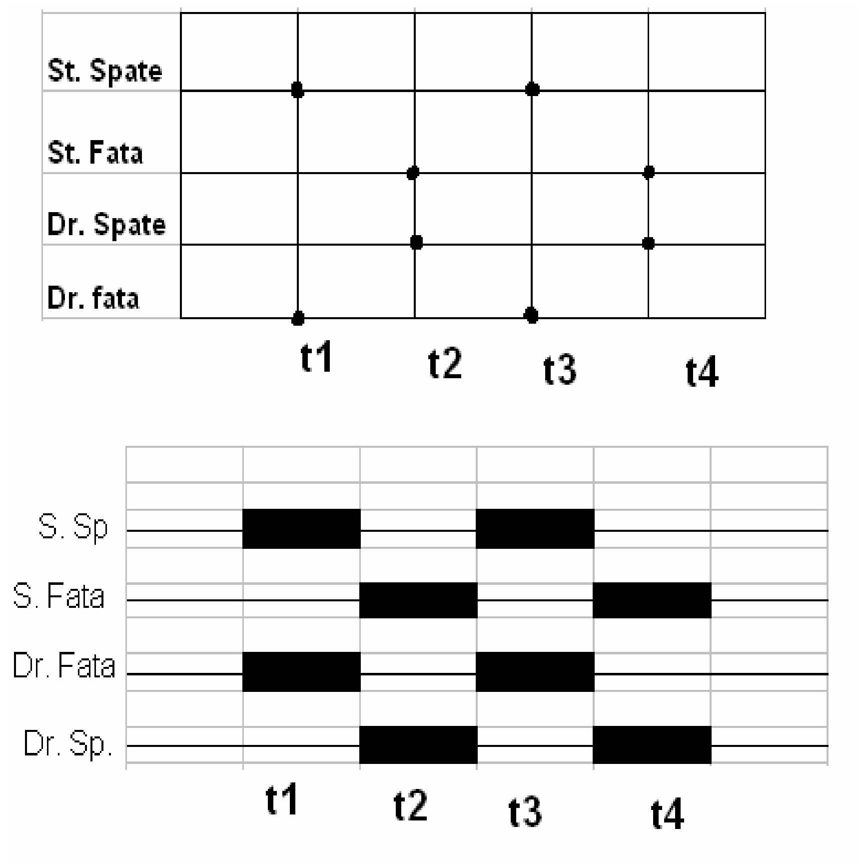


Fig. 5 The stepping diagram

4. CONCLUSION

The assembling mode of stepping robot's foots has an important role concerning the stepping. Using different reduction ratio in the actuating systems, an optimal variant for the robot's stability can be obtained. As the robot stepping is slower, the robot's stability is better.

The execution errors and the assembly errors lead to the robot's instability.
The use of the quadrilateral mechanism, in the foot structure, allows the description of the tiller curves when the stability function is chosen. Thus a pull, without the body control position, had been realized.

Using the 2D structures and the actuating with rotary engines, the working space is in acceptable limits.

5. REFERENCES

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