International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

IJIEMR Transactions, online available on 25th Jul 2021. Link :http://www.ijiemr.org/downloads.php?vol=Volume-10/ISSUE-07

DOI: 10.48047/IJIEMR/V10/I07/13

Title **A STUDY AND SYNTHESIS OF 8 BAR ONE DEGREE OF FREEDOM WALKING MECHANISM**

Volume 10, Issue 07, Pages: 65-71

Paper Authors

Venkata shiva

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

A STUDY AND SYNTHESIS OF 8 BAR ONE DEGREE OF FREEDOM WALKING MECHANISM

Venkata shiva
Prof/Ph.D/ Hod, Narsaraopeta Engineering College
samson.dara9@gmail.com

Abstract

When robotics emerge the researchers thrive to achieve obvious benefits for animals such as walking creatures, but all robots walking have its own drawbacks, using multiple actuators, and teamwork among these research drivers. Theo Jansen proposed a single degree of freedom that can differ with one actuator, but without the use of complex code needed by these mechanisms. It will create walking mechanisms like mechanisms.

A research is being performed in order to examine and discuss the advantages and drawbacks of the Theo Jansen walk mechanism and the second part of the thesis, synthesis using random sampling and fundamental mechanisms which would be more robust and effective than those already existed.

INTRODUCTION

NATURE'S INSPIRATIONS FOR LEGGED LOCOMOTION SYSTEMS

For various environmental factors, many species in nature have taken paws. Among those that have different number of legs and various kinds of walks are centipedes, spiders, cockroaches, cats, camels and kangaroos, and humans. It is understandable, after it was realized that human invented wheeled and tracked systems did not fulfill all requirements, that people turned their care to the walking animals. The legged structures have a peculiarity to mimic nature in this way.

This imitation is evident in the structural resemblance between legged robots and imitated animals; today, however, it is not just a structural imitation. In biologics and robotics, the essential aspect is the preparation and co-ordination of leg movements. Researchers are trying to understand the basic biological concepts of animal walking, namely the control and organizational mechanisms. Movement is a central feature of animal life. The locomotion over a surface of extremities or beings can be described as walking irrespective of how many limbs or legs are used for various means to walk.

The route design, the "gait pattern," specifies the sequence of the steps of the legs in each step, with their positions and their swinging times. Gait provides a description that is as follows: "The gait of an articulated live creature or walking machine is the movement of the beet of the corporate legs that can be defined in accordance with the body's movements as the time and location for the placement and raising of each foot, in order to move the body from one position to another."

It provides greater flexibility and adaptability to the environment at the expense of low speed and increased control complexity. It is important to have good models to explain movie behaviour, as walking machines are increasingly becoming important in the space for planetary exploration, where the terrain is rugged, thereby reducing expensively risky extra-vehicular activities by astronauts, in order to improve the Dynamic Model and control algorithm of legged Robotics.

LITERATURE REVIEW

The responsive regulation of swimming [Tan et al.2011], the bipid recreation by the muscle [Geijtenbeek et al.2013], the quadruped move discovery [Lee et al.2013], or bike stunts learning [Tan et al . 2014]. Most muscles will act as one in a focused sensory system for regular and efficient walkings for people and creatures. A robot needs multiple sensors and an intelligent curl controller to set up the actuators as muscles. It is difficult to manufacture in this context, because, if you are able to discover physically drives for any virtual machine, the cost for most applications and, in particular, for our simple automatons would surpass what is suitable: for toys and instructive applications, they have one motor, no sensors, and no abnormal state power. for each appendix,

A wide variety of advanced control mechanisms have been developed for people who have a physical imitation (Geijtenbeeket al.2013, Lee et al.2010), and the creatures of [Wampler and Popovic 2009, Coros et al. 2011], in order to create controllers [Gehring et al 2013] or improve the skill of progress c. These methods have been linked with modern legged robots. However, complex control strategies include complicated dynamics, sensors and actuators, and the StarlETH robot goes beyond the difficulty and expense of our automata objective as toys, which are basically simpler in their plans, but are still able to drive about. As such, the work is much closer to late computer work than to the general field of mechanical technology. Computer design and manufacturing This field alleviates the problem of design and assembly by producing devices that forget or reduce master space information requirements. For instance, late works show articles that have been specially formed and can fly, stay without nobody, or turn steadily, for instance [Prevost et al.2013] (Bacher et al . 2014). Some techniques are intended to transmit the virtual character to this reality today and currently it is conceivable of making 3D printable representations of the virtual characters with joints, [Bacher et al 2012; Calı et al.2012], of the design of mechanical toys fit for intriguing (non-skidding).

WALKING MECHANISM AND MACHINES

However, in 1960, small toys and automats, including bipedal walkers, have been manufactured in Europe from the 18th century, influenced by modern dynamic biping devices, including the Cornel bipeds, etc. It seems that the earliest walking machines were developed in the 1960s.

Research on walking machines was highly active following this early period. Machines were constructed on various scales, from insects of any size to small trucks of some sort. Several websites have comprehensive lists of walking machines The amount and ingenuity of different ways in which animals can inspire is astounding. Many potential walking devices have been tested: from enormous two footed drag-line pumps to twelve legged steam designs.

NUMBER OF LEGS

The walking machines are divided into groups by the number of legs. Animals are categorized as such too, including bipeds, primates and reptiles and quadrupeds, hexapods, puddles (arachnids), or polypods (caterpillars, centipedes and millips). Animals are often categorized as such.

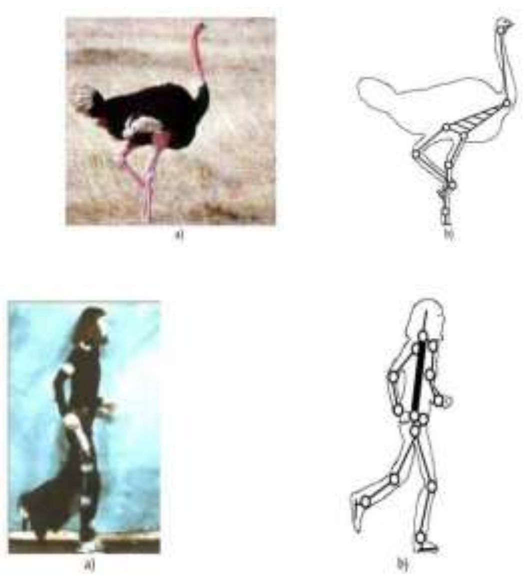

Figure Bio mimicking of Walking Mechanisms (Biped)

The number of legs affects the physics of walking significantly. To preserve the position of a structure in a three dimensional space, three support points are required. It's supposed to be dynamically balance if a machine is less than three legs. In other words, to prevent the walker from dropping, he must have a system in place to adjust the center of his gravity in relation to his foot position.

Mechanical design of walking machines

Although the superstructures of walking machines may be revolutionary, they are in general the legs of greatest significance. The technical concepts used in legs are strikingly minimal given the large range of walkers.

The vast majority of walking robots have pantograph mechanisms. Only the pantograph is the dominant mechanism for natural walkers when assembly of muscles / ligaments is regarded as extensible ties.

Pantographs

The reason pantographs are so omnipresent is their simplicity and polyvalence. Those are four-bar ties which have an interesting property in the normal configuration in which point O is calculated, which is amplified by point E in whatever film movement encountered by item A in Figure below. The aspect of amplification or scaling depends on the proportion of the connections.

The pantograph is a two-degree system of freedom, which involves two parameters to completely determine its location. In this case, before the position of foot, E, the x and y coordon of driving point A is decided, it is important to learn.

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

While this pantograph property is used to establish an effective foot trajectory, the pantograph is used in other modes. Point E movement is defined horizontally by moving point A and vertical point O. This leg mechanism is effective for the efficient propulsion of the adaptive suspension system, but two actuators per leg are needed.

Design Criteria

The parsimony principle (also called the "KIS" or Occam's razor principle) makes the requirement for the proposed walking machine much simpler. This principle isn't mentioned facetiously, but as an awareness of the complexity of the most laboratory-limited walking machines. During the design and production of this computer, KIS theory is to be applied continuously. In this respect, the conditions to be met by the potential walking machine are:

Static equilibrium, so no equilibrium control system is needed.

· Effective propulsion, as propelled legs stretch enormously the navigable area.

Towards minimum energy consumption.

· Minimum number of primary mover, enabling system installation and maintenance. The control scheme for the primary mover can be greatly simplified if only one primary mover can be used.

· A rotary motion rather than linear motion ideally should be needed as rotary primary motions are diversified, simple and easy to wear, particularly internal combustion engines and electric motors. Hydraulic or pneumatic linear actuators also need to be fitted for more sophisticated devices.

Deterministic foot route to remove the need for ground-sensing, impact management and leg-control systems.

§ A slow return mechanism to reduce the leg's return stroke's dynamic load.

• A rigid mechanism to assure the position control of the body's movement.

T he Machine management / interface with the surrounding area is possible by variable foot size.

· At the same horized plane, waling legs or legs with knees may be maintained to mitigate changes in potential energy.

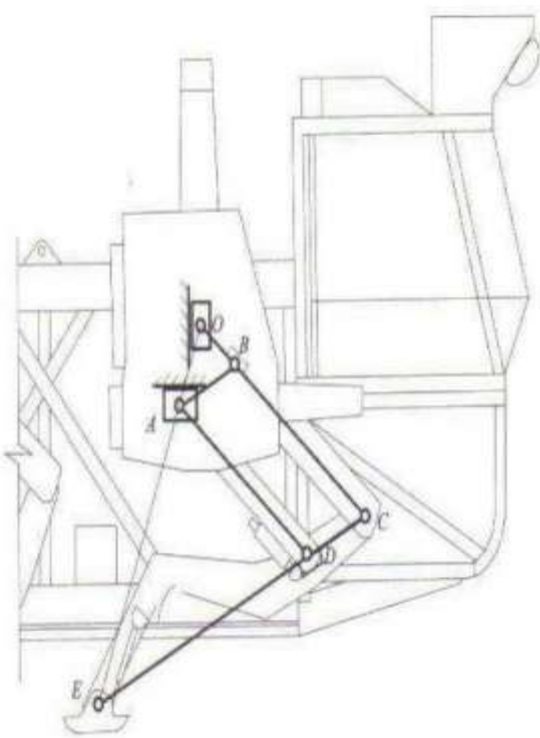

Figure Pantograph walking Mechanism 1

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

FOOT POINT TRAJECTORIES FOR WALKING

In order to properly operate the track followed by the foot of a walking machine is important. The direction of the mechanism is related to the overall design and configuration of the walking machine. The concept behind the project is to derive a walking method from Jansen 's work that specifies, as seen in the figure below, that the foot will follow a triangular path.

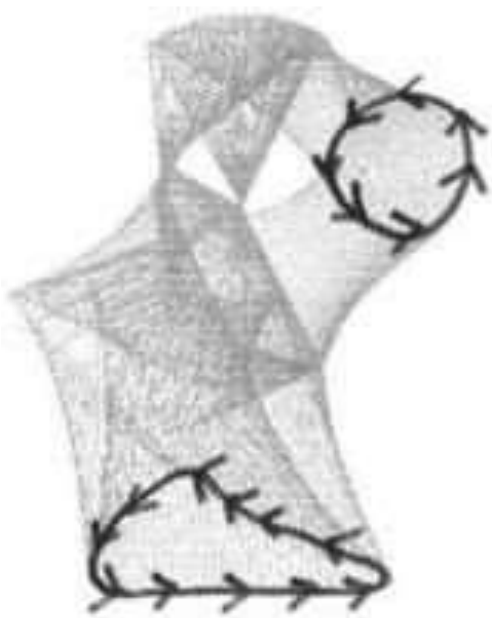

Figure Walking stride

The following figure indicates the direction, the foot will follow from left side of page to the right up a single step, as in the walking machine. The process starts at the middle of its course, at point 1. The foot leaves the ground at point 2, and goes by point 3 and 4 to point 5 on the way back, where the foot again takes the weight of the car. The illustration shows the additional argument, argument 4 that the foot could touch a staircase – the robot of Shieh had been built to go up the stairs.

LAMBDA CHEBYSHEV MECHANISM

The Lambda Mechanism from Chebyshev is a 4-bar mechanism that transforms rotational movement into approximate direct movement, at approximate constant speed. The correct configuration disrupts straightness, the absence of acceleration and the amount of rotation in the longitudinal section of the entire curve.

- In the near straight portion of the example on the right spends over half of the loop.
- The Lambda function of Chebyshev is a cognate relation with the Chebyshev domain.
- The first connection was displayed as "The Plantigrade Engine" in Paris at the Universelle Exposition (1878).
- The Lambda Mechanism of Chebyshev looks like a Lambda in Greek text, so the relation is also known as the Lambda Mechanism.

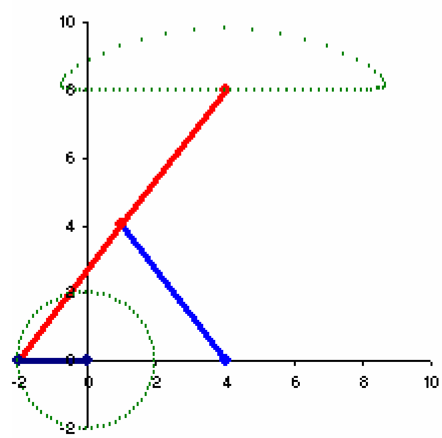

Fig Path trace by crank and output link of mechanism

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

While we watch the path traced by the output connection of the system traces a path that the ideal system needs, but this wouldn't solve the problem simply by turning the link backwards. A mirror mechanism was combined to create the desired walking effect to resolve the problem, but the present working defect has the following downside, such as:

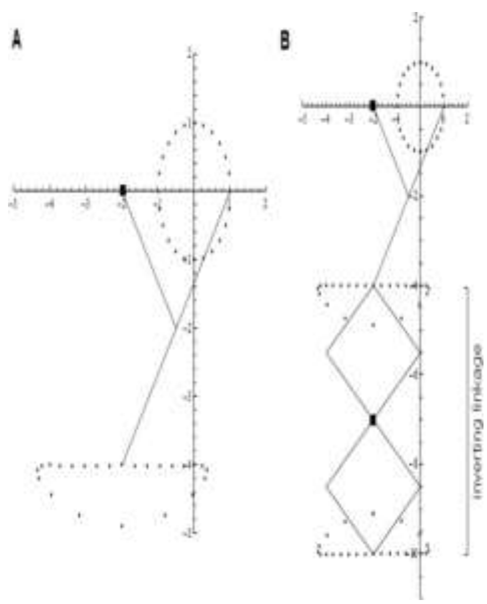

Fig (a) Flipped mechanism

Fig (b) Flipped mechanism coupled with mirror mechanism

- The present proposed mechanism comprises 12 connections that are higher than that of the current mechanism.
- The system occupies huge volumes and therefore requires a significant torque.

Behavior of Four Bar Mechanism

In the study of the above mentioned process , the following observations were made:

- One of the ends is fixed on the lower four-bar mechanism and the other three ends are followed by the path.
- The bottom end is the leg segment, the other two ends are traced by the middle semi-circle.
- The bottom end of the footstep course.

CONCLUSION

The following observation was made after the comparison of displacement, velocity and acceleration diagrams in solid works as shown in the table below:

	Theo Jansen Mechanism	Proposed Mechanism
Normalized Stride Length	1	1
Normalized Step Height	0.33	0.2491
Normalized Standard Deviation of y position	0.0070	0.0030
Normalized Mean x velocity	0.0020	0.01871
Normalized Standard Deviation of x velocity	0.0036	0.0018
Normalized Crank radius	0.22	0.2682
Normalized CM Y deviation (One leg)	0.14	0.079
Normalized CM X deviation (One leg)	0.36	0.071
Normalized CM Y deviation (Leg Pair)	0.064	0.053
Normalized CM X deviation (Leg Pair)	0.31	0.035
Normalized CM Y deviation (three leg pairs)	0.031	0.0041
Normalized CM Y deviation (three leg pairs)	0.018	0.011

REFERENCES

1. Aan, A. &Heinloo, M. 2012. Computer based comparison analysis of single and doubleconnecting-rod slider-crank linkages. *Agronomy Research* **10**, 3–10.

2. Aan, A., Heinloo, M., Aarend, E. &Mikita, V., 2012. Analysis of four-stroke cycle internalcombustion V-engine in Mathcad environment. *8th International DAAAM BalticConference 'Industrial Engineering'*, Tallinn, TTU Press, 389–394.
3. Aan., A. 2014. Jansen linkage. Available at: http://www.youtube.com/watch?v=B_dR2_O3ujc(30.01.2014)
4. Artobolevski, I.I. 1961. *Theory of mechanism and machines* (in Estonian). Tallinn, 743 p.
5. Moldovan, F., Dolga, V., Ciontos, O. & Pop, C. 2011. Cad design and analytical model of a twelve bar walking mechanism. *Scientific Bulletin*, Series D, **73**(2).
6. Jansen, T. 2007. *Theo Jansen: The Great Pretender.* Rotterdam, 010 Publisher, 240 p.
7. Komoda, K. &Wagatsuma, H. 2011. A study of availability and extensibility of Theo Jansenmechanism toward climbing over pumps. *The 21st Annual Conference of the Japanese*
8. *Neural Network Society.* OIST, Okinawa.Komoda, K. &Wagatsuma, H. 2012. A proposal of the extended mechanism for Theo Jansenlinkage to modify the walking elliptic orbit and a study of cyclic base function.
9. *Proceeding 7th Annual dynamic walking conference.* IHMC, Florida, 143–145.Giesbrecht, D., Wu, C.Q. &Sepehri, N. 2012. Design and optimization of a eight-bar leggedwalking mechanism imitating a kinetic sculpture, 'Wind Beast'. *Transactions of theCanadian Society for Mechanical Engineering* **36**(4), 343–355.Ingram, A.J. 2006. Phd thesis: *A new type of mechanical walking machine*. University ofJohannesburg, 158 p
10. Lepik, Ü. & Roots, L. 1971. *Theoretical mechanics* (In Estonian). Tallinn, pp 483.
11. Lepikson, H. 1998. *Design of kinematic scheme for four-stroke internal combustion V-engine*(in Estonian*).* Tallinn, 76 p.
12. Shigley, J., Mischke, C. & Brown, T. 2004. *Standard handbook of machine design.* McGraw-Hill, 1200 p.