DEVELOPMENT OF BIODEGRADABLE CRAWLING ORIGAMI BASED ROBOT

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Overview

The implementation of bio-inspired robotics in current scenario has been widely used in various fields of engineering and technology such as aerospace, medical field etc. Therefore, after going through various research work and literature survey, it was founded that the field is quite interesting there is various opportunities that can be pursued in terms of applications and technology enhancement. In the same context, a bio-inspired crawling robot has been designed and developed by using a Japanese technique of paper folding based on kresling pattern.

In this technique, a linear actuation system has been designed by using thick paper, to prevent wear and tear, folded on a crease pattern of mountain and valley fold. As a consequence of folding, generation of a design occurred with the property of expansion and contraction while twisting with the means of torque applied by moving shaft of motor.

This dual model of paper is termed as ‘origami tower’ and there is another structure of same material, for external cover and support, is provided to robot which in results protects the robot and consistently helps robot in proper locomotion. This model is termed as ‘Origami Bellow’. This structure also has been created by using thick paper and specified design and crease pattern.

Further, there are various hinges and plates, support has been designed and fabricated with different software and 3d printer in order to get an assembly for the robot which are responsible for motion in the physical model. The plates at the field lines preclude the shape transformation associated with the bi-stability of robot which help in the kinematic analysis of the robotic structure.

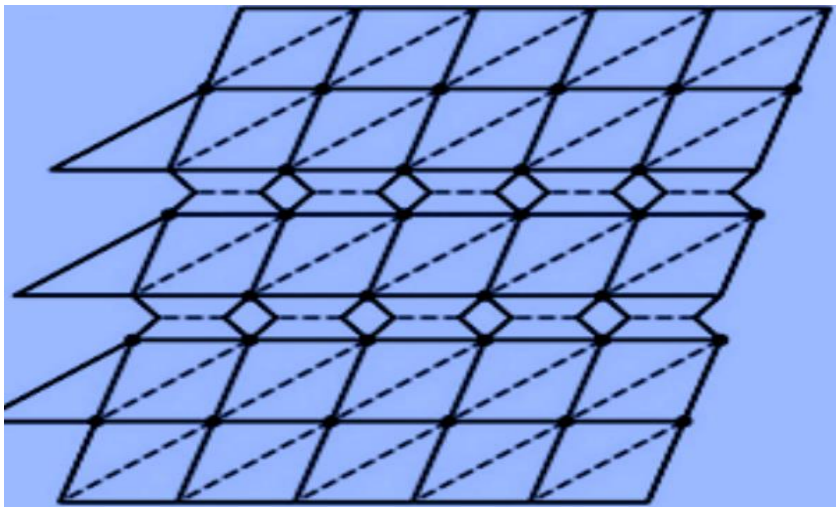

Figure 1: Kresling Pattern

The model has been designed and the simulation for distinct parameters has been performed by using software like coding software, solidworks etc. to get proper design and appropriate analysis of behaviour of origami tower during expansion and contraction during application

of twisting torque. On the basis of analysis, physical model has been developed to get crawling motion on different terrains from flat crease pattern by implementation rolling into a polygonal prism. After application of force on the top portion of structure, twisting by motors and other controllers, wires and power system, expansion and contraction will exhibit the snapping motion.

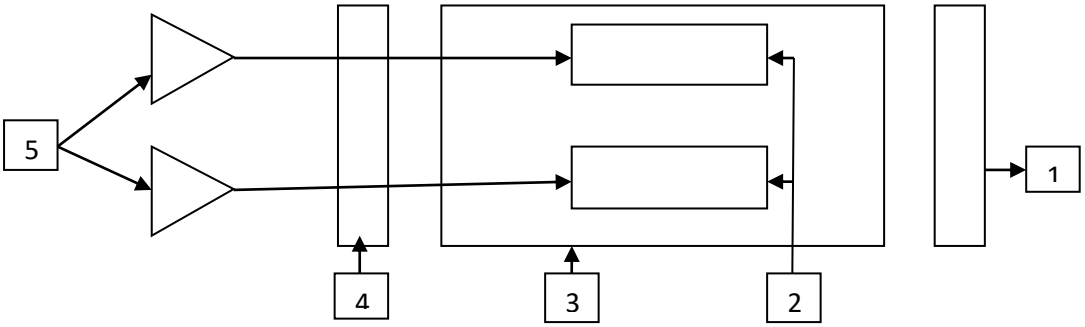

Figure 2: Block diagram of physical model of robotic structure

1. Front face plate.
2. Origami towers.
3. Origami bellow.
4. Rear face plate
5. Servo motor

There are different values of robot regarding motion and time has been taken as data and plotted to justify the directional motion of robot in forward, right and left direction. A virtual reality based system has been developed by using software which replicate the robot and surrounding for crawling motion.

Conclusion

This model presents design and analysis of a bi-stable origami robot, which can be utilized for various configurations, open, closed, and turning or bent with stability. The model has been fabricated and it can find its applications in robotics along with other various fields. It has advantages of open loop control straight forward locomotion. This project can have better applications and can serve various fields of medical, aerospace, according to requirement.

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