A Double Eccentric Circular Variable Eccentricity Widening Components and Wheel Foot Robots

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Abstract. This paper presents a double eccentric circular variable eccentricity widening components, including the Inner wheel and outer wheel. The inner wheel can be rotated in the outer wheel, and the outer ring surface of the inner wheel is provided with a plurality of first limit means, the inner ring surface of the outer wheel is provided with a second limiting device cooperating with the first stop device. The robot can be used as eccentric foot structure robot. It can also be a regular round wheel structure robot. When the robot is moving on a flat ground, the obstruction wheel switch to ordinary round mode. Ordinary round wheel of the power axis is located in the center, walking without ups and downs, high efficiency. In the non-flat ground motion, the obstacle can be used as a eccentric wheel. The power shaft of the eccentric wheel deviates from the center of the circle, obstacle ability is better. In this invention, the robot's obstacle wheel can switch freely in eccentricity and center, the size of eccentricity can be adjusted in real time according to the height of obstacles in the more obstacle environment. The higher the obstruction, the greater the eccentricity of the obstacle wheel.

Introduction

The motion mechanism of existing mobile robot can be roughly divided into: wheel, crawler, more foot type, hybrid, such as wheel leg hybrid and fulfillment of wheel hybrid and special form. the multi-feather and special forms are mostly bionic class walking mechanism, with strong barrier capability and terrain adaptability, but the mechanical structure of these two types of walking complex, difficult to control, mobility is relatively poor, is currently in the research and development of the initial stage of application. After a hundred years of development, the track has proven to be a walking mechanism that can accommodate complex terrain and harsh environments, but its shortcomings are obvious: bulky, requiring high-power drives, so there are strict limits on portable or power of the mobile robot is not suitable for crawler.

Structural Design of Double Eccentric Circular Variable Eccentricity

In this paper, a bi-eccentricity circular variable eccentricity is introduced, including an inner wheel and an outer ring which are the same as the eccentric wheels, The inner wheel can rotate in the outer wheel, and the outer ring surface of the inner wheel is set with a number of first limit device, The inner ring surface of the outer ring is provided with a second limiting means cooperating with the first stopper means. The first limit device of the component is the depression part, and the second limit of the component is the expansion part of the concave part, which is set in the inner wheel and the outer wheel of the assembly to have the drive hole.

The Overall Structure of the Wheeled Robot

The double eccentric circular variable eccentricity is used as the wheel of the robot, the body of the robot is a flat and narrow structure, which allows the robot to turn over and not affect its walking. The front end of the body has the obstacle support, and the bottom of the body has silicone rubber as the antiskid layer, the assembled wheel foot robot is shown in figure 2.
Structure Design of Wheel Foot Robot

The robot in this paper can adjust the size of the eccentricity of the barrier wheel according to the maximum height of the obstacle in the obstacle, the eccentricity is defined as the distance between the axis of the drive shaft of the motor and the center (center) of the outer ring of the double eccentric circular variable eccentricity. Where the radius of eccentricity L is in the range of \([0, R)\), where R is the radius of the outer ring of the double eccentric circular eccentricity trapping wheel, assuming that the distance from the axis of the drive shaft to the robot chassis is \(E\). The maximum height of the obstacle that the robot can cross is close to \(R + L - E\). The present invention can be used as an eccentric foot construction robot when the eccentric circular eccentricity is greater than the eccentricity, i.e., when the drive shaft approaches the edge of the outer wheel, and the robot can reach the maximum height of the obstacles, as shown in Figure 3.
height is $R + L - E$. Where $E$ is the distance from the axis of the drive shaft of the motor to the robot chassis, and $R$ is the radius of the outer eccentricity of the double eccentric circular eccentric yaw barrier, as shown in Figure 4.

![Figure 4. Variable eccentricity Structure diagram.](image)

**Experimental Results**

In this paper, there are six kinds of wheeled robot design: reset, forward, backward, turn left in situ, turn right and stop. Note that before the robot performs the appropriate action mode, it is generally necessary to adjust the eccentricity of the obstruction wheel to the proper position so that the robot can cross the corresponding height obstacle.

When the robot performs the forward algorithm, it is divided into two cases:

1. travel device (double eccentric circular variable eccentric distance barrier wheel) 3 adjusted to the ordinary center wheel, in this gait, the robot's four rounds need to keep the same phase rotation.

2. Walking device (double eccentric circular variable eccentric distance barrier) Adjust the eccentric wheel. In this gait, first of all, the robot can be based on the height of the obstacle to adjust the size of the eccentricity of the barrier wheel, eccentricity range of $[0, R)$, where $R$ is a double eccentric variable eccentricity the radius of the outer ring of the wheel. If the eccentricity is assumed to be $L$, the distance from the axis of the drive shaft to the robot chassis is $E$, the maximum height of the obstacle that the robot can cross is close to $R + L - E$. the experimental results are shown in Fig 5-1, 5-2, 5-3, 5-4, 5-5, 5-6.

![Figure 5-1.](image) ![Figure 5-2.](image) ![Figure 5-3.](image) ![Figure 5-4.](image) ![Figure 5-5.](image) ![Figure 5-6.](image)

When the robot performs the back-off algorithm, the bi-eccentric circular eccentric wheeled robot uses a flattened and long-like structure, and the four pairs of eccentric circular deviations are symmetrically mounted on both sides of the body, respectively, back is the forward of the reverse movement, the performance is the reverse rotation of the motor. When the surface is advanced and retreated, the travel device is generally adjusted to a normal center wheel, as shown in Fig 6-1, 6-2, 6-3, 6-4, 6-5, 6-6. In the non-regular ground forward and backward barrier, the walking device is generally adjusted to eccentric wheel.
When the robot receives the in-situ left turn signal, and the robot turns left until another control signal is received. does not move, the right side of the two motors are rotating an integer number of cycles to achieve the left side of the machine to turn left, the ideal turning angle is required, as shown in Figure 7-1,7-2,7-3,7-4,7-5,7-6,7-7,7-8.

Conclusion

The design is a simple and reliable structure, high efficiency, good surface adaptability, barrier capability double eccentric circular eccentric wheel foot robot. It is possible to adjust the eccentricity of the traveling device 3 to 0 when it is necessary to walk on the ground, and the present invention can be used by a conventional round robotic robot, and the walking efficiency is high. When it is necessary to travel on a non-flat ground, the eccentricity is adjusted to any value in (0, R) (where R is the radius of the outer ring 31 of the obstruction wheel). At this time, the present invention can be used for eccentric foot structure robots, and the barrier capability is strong and can be adapted to different Height of the obstacle. Can improve the use of wheeled robots’ barrier capability, so that robots can take into account the stability of the regular terrain system power consumption and the efficiency of walking.

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References


