Advances in Aerospace Science and Applications.
ISSN 2277-3223 Volume 3, Number 2 (2013), pp. 91-94

http://www.ripublication.com/aasa.htm

Design Concept of a New Flight Vehicle

Junaid J

Department of Aeronautical, SAMS College of Engineering and Technology, Anna University, Chennai, Tamilnadu.

Abstract

The development of a cyclogyro is presented in this paper. There exists many design of a cyclogyroes but they are quite crude and do not fully deal with problems of stability, yawing, pitching, and rolling. By the design discussed in this paper it has solved the problems. But, the design and mechanism is very rigorous. The mechanism is four bar mechanism used here is a good choice and results good. On the experiment conducted by this mechanism has a good result so far. The mechanism is which is selected for this design for the motion of flight in all aspects like stability, yawing, pitching, and rolling too.

By comparing it with the other cyclogyros which are designed earlier, the newly designed cyclogyro by this mechanism has a good fly. Further, the new mechanism is also under study to improve the performance and also the design pattern.

Keywords: Cyclogyro, four bar mechanism.

1. Introduction

The cyclogyro is a kind of aircraft using cycloidal propeller to generate lift and thrust. The cycloidal propulsion system is composed of two or more blades that rotate around an axis parallel to the blades. When aircraft hovers, the blade travels along a cycloid. With the pitch angle controlled by certain mechanism, usually the eccentric, the desired direction of the total aerodynamics force can be obtained. When the position of the eccentric is moved, the direction of the total forcr vector can be varied 360deg.This provides the aircraft 360deg vector thrusting, which greatly improve the maneuverability of the airplane.

My effort in this paper is to develop the cyclogyro with an successful flight by introducing the four bar mechanism for controlling the flight during the fly for its

hovering, pitching and yawing. As there is no successful recorded flight of an cyclogyro till now.

2. Model and Mechanism

The model is designed aerodynamically for flying in the atmosphere. The fuselage is designed in an shape of an aerofoil for an smooth airflow over it and also to experience a small amount of an lifting force. Either side of a fuselage is attached with a propeller rotating at a high rpm.

The mechanism used for controlling the flight during the flight condition is, four bar mechanism. I have used four bar mechanism for the hovering and forward flight. It controls the blade angle by tilting it to a required angle for the hover and forward flight. Due to an aerodynamic force occurring by changing the blade angle the maneuvering of an flight is achieved. It is attached at the end of a propeller main shaft and controlled using the servo mechanism. The yaw control is maintained with tail rotor. Tail rotor not only balance the torque, yawing but also experience force for flying.

This mechanism is very bulk and also should be operated by reducing the speed of a propeller which would be rotating at a high rpm. The structure of an mechanism is made strong, due to undergoing a large amount of an force.

3. Propeller Design

There exist many design of a horizontal axis rotating propeller namely “T” shape. ”Pi” shape, ”n” shape. On the test conducted on each type of an propellers the ”T” and “n” shape propellers design shows very much structurally weak and also much heavier. Thus maintain the control mechanism using this design shape of a propeller is quite impossible thus undergoes breaking condition during the high rpm.

The “Pi” shaped propeller design was good in turn shows good rotation at a high rpm without any breaking and much more noise vibration too. Thus “Pi” shape propeller is selected for this cyclogyro, during the rotation of a propeller it experience two forces centrifugal, aerodynamic forces. Centrifugal force is obtained due to the rotation with an main shaft with the blades attached to it. Aerodynamic forces is achieved by rotating the blades with high rpm and they undergo a flow over the blades and gain the aerodynamic force that is useful for an flight to fly.

This type cyclogyro used four blades and two propellers attached either side of a fuselage. The blade is airfoil shaped NACA0012 which gives good lift amount during the rotation of a propeller. Previously, the test was also made using the thin flat plates which gives less amount of lift force compared to the airfoil shape. But, the criteria is that rpm differs according to the shape of a blades.

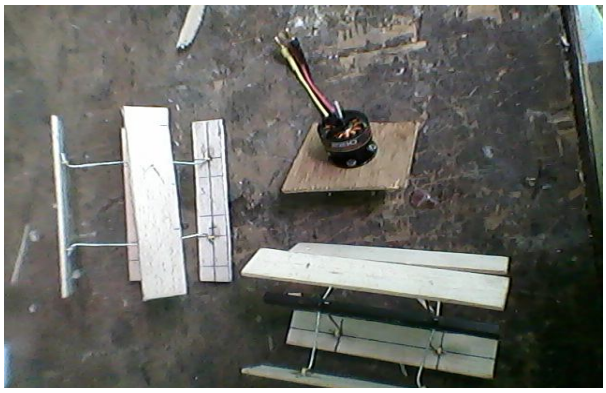

Fig. 1: Propeller blades and motor during experiment.

On comparing with the previous design developed by Hu Yu, Lim Kah Bin from National university of Singapore, the mechanism designed by them does not give an stable flight condition. Another type of an MAV type cyclogyro by same university uses cycloidal propeller and control the flight mechanism using the swash plate and eccentric control mechanism.

Many such design are named as cyclocopter uses four propellers like quadcopter and maintain the hovering, forward flight. It is easy to achieve using the four propeller by adjusting the rpm and the direction of rotation. Certainly in the quadcopter also only hovering flight is achieved.

But the model and design discussed in this paper is entirely with four bar mechanism achieving all the flight condition with a good stable flight.

4. Conclusion

The cyclogyro design model discussed in this paper using the “Pi” shape propeller with the control mechanism as four bar mechanism has a very good flying condition in hovering, forward flight and yawing. Thus, a very good successful flying cyclogyro is achieved with all flight maneuvering which has not yet been achieved by previous models of cyclogyro.

References

[1] Hu Yu, Tay Wee Beng, Lim Kah Bin, National University of Singapore, 2006.
[2] R.W. Prouty, Helicopter Aerodynamics. Philips Publishing, Inc.
[3] Du Fan, Jian Jun, Ma Kaichao, Wang Gang, Chen Kaiyan, School of aeronautics, Northwestern polytechnical University, P.R.China Ren Bin Chengdu Jouav A utonation Tech Co., Ltd, P.R.China,2001.
[4] Jonathan Edward Caldwell Cyclogyro,1939.
[5] ATSC Cyclogyro, 1942.