Research on Speed Control of Coaxial Twin Rotary Helicopter by Using PID Control

Y. H. Ma, K. H. Lee, and G. R. Lee,

***Abstract*—This paper proposes to apply the PID axis control method to the research on the speed stability control of the new coaxial dual-rotation electric helicopter power transmission system. Based on the design of the new coaxial dual-rotation electric helicopter power transmission system proposed in previous research, this paper proposes to apply the PID axis control method to control the operating speed of the three motors, and ultimately achieve stable control results.**

I. INTRODUCTION

In recent years, UAVs have been used in various fields, such as agriculture, transportation, and other civilian applications. The hybrid development of various types of drones and the emergence of bionic drones[1~4]. This study proposes a control method to improve helicopter propeller speed. In the research, the shafts of helicopters are used to make separate models to achieve a more stable operation of the helicopter without being affected by factors such as shaft rupture or damage to the power supply system.

II. METHODS AND RESULTS

The new structure of the new electric helicopter power transmission system proposed in this paper uses the internal gear of the star gear, which combines the internal gear drive shaft in the star gear. The motor is combined to drive the internal gear to rotate, and then the internal gear drives the external gear to rotate. The external gear is driven by the internal gear, and when rotating, it also drives the outer peripheral blade to rotate. The design of the distributed power control system proposed in this paper is that each motor is equipped with an independent electronic speed controller (ESC), and it is also connected to the battery management system and battery module. The design of decentralized independent electronic speed regulators can avoid the problem of overloading a single electronic speed regulator.

The 3-motor helicopter axis control studied in this paper can achieve vehicle stability shaft of helicopter. However, due to the length of operation or the configuration of the payload, the helicopter may not be able to reach the destination smoothly during operation and cause undesirable consequences and damage. Fig.2 is a PID control measurement data curve. From this figure, there are different speed responses through different Kp, Ki, and Kd parameter values. It can be analyzed from the curve that although the rotary speed control can eventually stabilize at the target speed of 800rpm. The current time to reach a steady state is about 20 to 25 seconds.

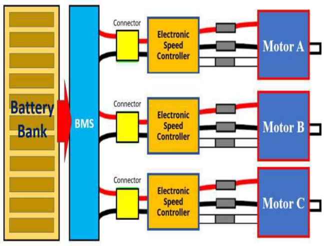

Figure 1. The block diagram of the helicopter power system

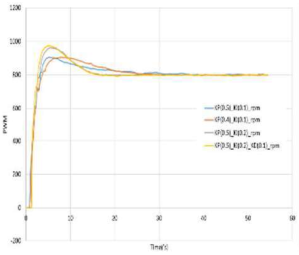

Figure 2. PID curve

III. CONCLUSION

This paper proposes to apply the PID shaft control method to the research on the speed stability control of the new coaxial dual-rotation electric helicopter power transmission system. The PID shaft control method is used to control the operating speed of the three motors and achieves stable control results. The test results show that the method proposed in this paper can stably control the speed at the target speed of 800rpm, but its response speed is between 20 and 25 seconds, which is still making improve progress.

ACKNOWLEDGMENT

This research is supported by the research project of the National Science and Technology Council of Taiwan (Project No.: NSTC112-2221-E-262-006). We would like to thank you hereby.

REFERENCES

[1] H. Shakhatreh, et al., Unmanned aerial vehicles (UAVs): a survey on civil applications and key research challenges, IEEE Access 7 (2019) 48572–48634, https://doi.org/10.1109/ACCESS.2019.2909530.

[2] K. Kanistras, G. Martins, M.J. Rutherford, K.P. Valavanis, Survey of unmanned aerial vehicles (UAVs) for traffic monitoring, in Handbook of Unmanned Aerial Vehicles, Springer, Dordrecht, Netherlands, 2015, pp. 2643–2666.

[3] J. Everaerts, The use of unmanned aerial vehicles (UAVs) for remote sensing and mapping, Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci. 37 (2008) 1187–1192.

[4] M. Hassanalian, A. Abdelkefi, Classifications, applications, and design challenges of drones: a review, Prog. Aerosp. Sci. 91 (May 2017) 99–131,

[1] *Resrach supported by National Science and Technology Council of Taiwan.

Y. H. Ma is with the Department of Electronic Engineering, Lunghwa University of Science and Technology, Taiwan (corresponding author to provide phone: 02-82093211; e-mail: yhma@gm.lhu.edu.tw).

K. H. Lee is with the Department of Electronic Engineering, Lunghwa University of Science and Technology, Taiwan (e-mail: Garylee4204@gmail.com).

G. R. Lee is with the Department of Electronic Engineering, Lunghwa University of Science and Technology, Taiwan (e-mail: Garylee4204@gmail.com).