Introduction of a Flight Controller into a Swashplateless Control System for Small Helicopters

Mason McMahon   
*Dept. of Computer Science and Engineering  
Wright State University*Fairborn, OH  
mcmahon.mason22@gmail.com

*Abstract*— This paper explores the theory, design, and implementation of a control scheme for altering blade pitch without the use of a mechanical swashplate. By modulating the duty cycle sent into the motor we were able to achieve cyclical control. This allows for full pitch, roll, and thrust control without the need for any other actuators to be present in the system.

It’s recommended to insert figures inside a text box. So your figure would go here (adjusting the text box to the appropriate size to match).

# Motivation & Problem Statement

A helicopter is a type of rotor craft capable of generating lift and thrust through horizontal spinning rotors. In order to achieve full 3-dimensional locomotion, a control scheme must be used to vary the pitch of the rotor. Traditionally, large helicopters will use a swashplate, a mechanical device that transmits control inputs from the stationary fuselage to the rotating rotor blades through the use of mechanical linkages connected to a rotor disc. This introduces cyclic control where tilting the swashplate in a particular direction changes the pitch of each blade cyclically during its rotation, tilting the rotor disc and moving the helicopter forward, backward, or sideways. Additionally, raising or lowering the swashplate uniformly changes the pitch of all blades simultaneously, increasing or decreasing the overall lift.

While this works very well for large helicopters, it becomes a much more challenging approach for smaller remote controlled vehicles.

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You can cite your references in text by including the corresponding number, in square brackets [1]. If you need to cite a specific part of the source, you can include a page number [2, p. 13] or range [3, pp. 41–56].

##### Acknowledgments

“Acknowledgment(s)” is spelled without an “e” after the “g” in American English.

As you can see, the formatting ensures that the text ends in two equal-sized columns rather than only displaying one column on the last page.

This template was adapted from those provided by the IEEE on their own website.

##### References

1. D. V. Lindberg and H. K. H. Lee, “Optimization under constraints by applying an asymmetric entropy measure,” *J. Comput. Graph. Statist.*, vol. 24, no. 2, pp. 379–393, Jun. 2015, doi: 10.1080/10618600.2014.901225.
2. B. Rieder, *Engines of Order: A Mechanology of Algorithmic Techniques*. Amsterdam, Netherlands: Amsterdam Univ. Press, 2020.
3. I. Boglaev, “A numerical method for solving nonlinear integro-differential equations of Fredholm type,” *J. Comput. Math.*, vol. 34, no. 3, pp. 262–284, May 2016, doi: 10.4208/jcm.1512-m2015-0241.

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