华南理工大学
South China University of Technology

研 究 生 课 程 论 文

(2022-2023 学年第一学期)

INDI-based Angular Velocity Control for a Ducted Fan UAV with Redundant Actuators

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提交日期： 2023 年 8 月 2 日　　研究生签名：蒙超恒

学　　号		学　　院	自动化科学与工程学院
课程编号	B0811033	课程名称	Navigation and Control of Autonomous Systems
学位类别	博士	任课教师	裴海龙 教授
教师评语：			
成绩评定：　　分		任课教师签名：	年　月　日

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Name

Abstract: Abstract Abstract Abstract Abstract Abstract Abstract Abstract .

Keywords: Keywords, Keywords, Keywords, Keywords.

1. Introduction

The ducted fan unmanned aerial vehicle (UAV) is the aircraft that the propeller/rotor/fan is installed inside a circular duct while control vanes are involved to stabilize the attitude of the vehicle, as show in Fig.1.

In the earlier works on the ducted fan UAV control[1-2].

This paper proposes a prioritized control allocation algorithm in which the control allocation problem is solved by an optimization technique.

The contributions of this work are:

1. An angular velocity.

2. A algorithm is proposed to solve.

3. Combine. We release our implementation as open-source software[2], which includes a simulation that enables more experimentation.

[1]https://youtu.be/978SQ7nIA50

[2]Source code of the proposed method will be released in https://github.com after the publishing of this paper.

Fig. 1. Ducted fan UAV, weighing $1.5kg$ and configured with a $9inch$ ducted rotor, which equipped with *PX4* autopilot. Details about the experiments are shown in this video[1].

2. Ducted Fan Modeling

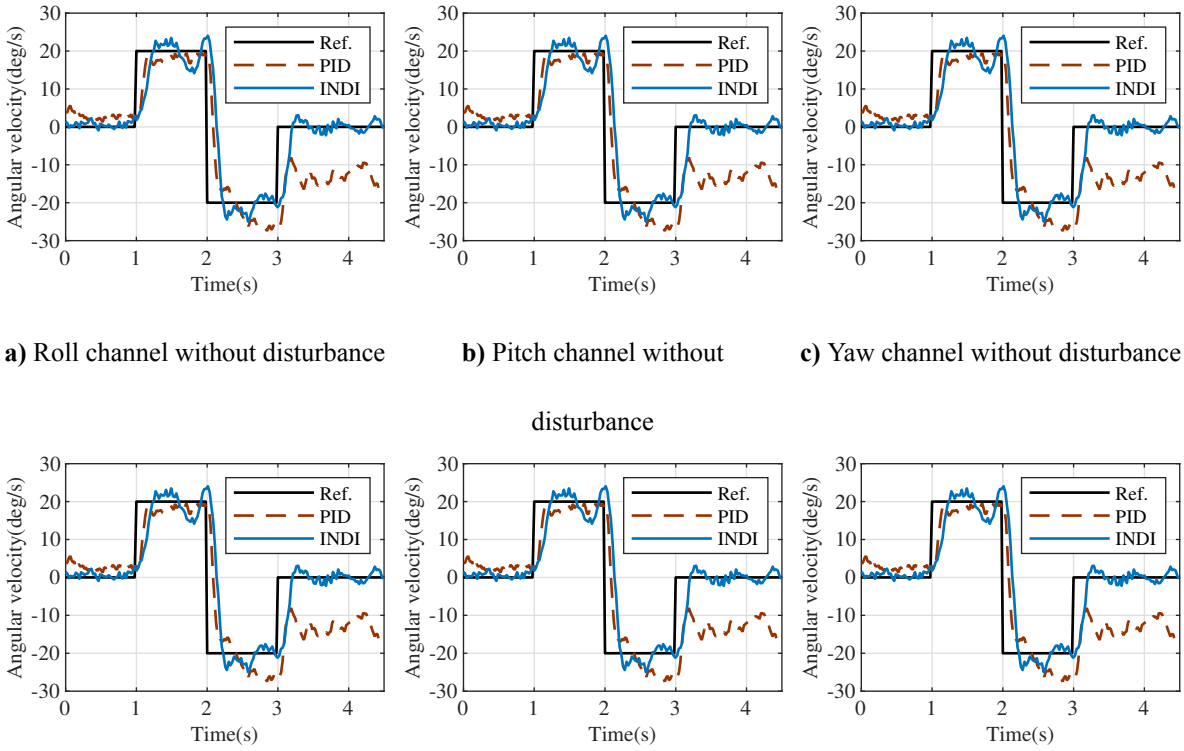
Modeling

3. Results

3.1. Experiment 1

The results of experiment 1 are presented in Fig.2, in which Fig.2 a) b) c) are the results in the absence of the actively produced disturbance, while Fig.2 d) e) f) are the results under the actively produced disturbance. Obviously, we can state that the overall control performance is less satisfactory under the PID controller.

Furthermore, contrast to the PID controller, it seems that the introduction of the disturbance affects nothing on the system responses under the INDI controller. With and without the disturbance, the tracking performance shows no difference on each attitude channel. This is due to the fact that INDI is capable of estimating and compensating the exogenous disturbance instantly, while PID acts mush slower since it relies on the accumulation of the tracking error. In all, it is



a) Roll channel without disturbance **b)** Pitch channel without disturbance **c)** Yaw channel without disturbance

d) Roll channel with disturbance **e)** Pitch channel with disturbance **f)** Yaw channel with disturbance

Fig. 2. Results of experiment 1

revealed that the proposed INDI controller can achieve well tracking performance with excellent disturbance rejection ability. Furthermore,

References

[1] Manouchehri A, Hajkarami H, Ahmadi M S. Hovering control of a ducted fan VTOL Unmanned Aerial Vehicle (UAV) based on PID control[C]//2011 International Conference on Electrical and Control Engineering. 2011: 5962-5965. DOI: 10.1109/ICECENG.2011.6057155.

[2] Peddle I K, Jones T, Treurnicht J. Practical near hover flight control of a ducted fan (SLADe)[J]. Control Engineering Practice, 2009, 17(1): 48-58. DOI: 10.1016/j.conengprac.2008.05.004.