The Matlab Source Code for Optimization of Multicopter Propulsion System Based on Degree of Controllability

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I. Introduction

This file set is a supporting material for our paper [1]. The optimal design problem of multicopter is considered in this paper. First, the entire multicopter system model is derived, where the propulsor dynamics is considered. Then, based on the complete multicopter model, an optimized design methodology for multicopters based on DoC is proposed. In addition, a step-by-step process is derived from the methodology, which is used to design a compound hexacopter with different required vehicle masses to demonstrate its effectiveness. Further discussions about the design results of the compound hexacopter are presented to demonstrate that the design methodology is effective.

II. File List and Usage

Please use Matlab to run all of the files in the file set. All the M-files have been checked availability on Matlab R2016b.

1) data sheets/Start.m: Use the "data_sheet.xlsx" file to pruduce the datesheets for the design process. The results are saved. Input: none. Output: "data_sheets.mat", "data_text.mat".
2) Start.m: Get the optimal design for a fixed m_{vehicle}. You need to set the recovery time "T_com" and the desired mass "M_vehicle". Input: none. Output: if M_vehicle=10, T_com = 0.5, the output will be the data file "dataset_17KG_T0.5.mat".
3) Start_loop.m: Get the optimal designs for a list of m_{vehicle}. You need to set the recovery time "T_com". Input: none. Output: a list of data file similar to "dataset_17KG_T0.5.mat".
4) optimization_pre_propeller.m: Compute the mass of the propellers. Input: data_sheets.mat. Output: data_sheets_prop
5) optimization_pre_weight.m: Get the candidate propulsors that can meet the weight requirements. Input: data_sheets_prop. Output: data_sheets_weight.
6) optimization_pre_size.m: Get the candidate propulsors that can meet the size requirements.Input: data_sheets_prop, data_sheets_weight. Output: data_sheets_size.
7) optimization_DoC_rate: Compute the maximum DoC for each candidate design. Input: data_sheets_size, data_sheets_prop. Output: data_sheets_doc.
8) results analysis/Start_results.m: Convert the design data file to *.xlsx file, from which we can get the optimal design.

9) results analysis/Start_results_loop.m: Convert a list of design data file to a list of *.xlsx files, from which we can get the optimal design of each desired mass.

III. NOTICE

Please read the specification in the files to get the further information. If you have any questions, then please feel free to contact Prof. Quan Quan (qq_buaa@buaa.edu.cn). If you use these files or results in your paper, please cite [1] and:

Guang-Xun Du, Quan Quan, and Dongjie Shi, "The Matlab Source Code for Optimization of Multicopter Propulsion System Based on Degree of Controllability", http://rfly.buaa.edu.cn/, January, 2018.

REFERENCES

[1] Guang-Xun Du, Quan Quan, and Dongjie Shi. Optimization of Multicopter Propulsion System Based on Degree of Controllability. Submitted, January, 2018.