Propulsion Subteam MATLAB Code Overview Part 1

Legend

- input variables
- MATLAB script
- outputs

Import Data

MotorFile Motor_data.xlsx
An input variable containing the imported Motor excel sheet, which contains: **NAME, Kv, Rm, and I_0** of various motors.

PropFiles [Propnames].xlsx
A input variable containing all the imported Propeller Data sheets. Each propeller data sheet contains: V, J, Pe, Ct, PWR, Torque, Thrust of each propeller type.

Generate_Mat_File.m
MATLAB file script that reads all the data in Motorfile and Propfiles and outputs DataImport.mat.

DataImport.mat
.mat file which stores the workspace variables from Genera_Mat_file.m. Contains variables: **Cp, Ct, diameter, I0, J, Kv, maxRPM, Motornames, Pe, pitch, Propnames, PWR, Qprop, Rm, T, V**

Efficiency Optimization

Input Parameters
Mission 1-3
cp, cm, Ampdraw, RPMcruise, speed, Voltage

Input Parameters
PropFiles, numProps, numRuns, M1, M2, M3

Input Parameters
numProps, Voltage, Mreq = [Thrust CruiseAirSpeed] (taken from Aero Team)

Data_Visualization.m
The purpose of this script is to visualize and put as much information into several plots. In order to find the most efficient propeller/battery, motor combination, other scripts must be used. This script only is for visualizations.

Run_analysis.m
Uses mission speed parameters to find the ideal propeller and motor combination for each mission. Calls Propulsion_analysis_fun.m to complete the analysis.

Prop_Motor_Code.m
Master Optimization Script
Script responsible for running the propulsion analysis and finding the best combo of propellers and motors for each mission.

MATLAB Figures 1-6
Figure 1: Static Thrust Capabilities for [Propeller Name] on [Motor Name] (Thrust vs. Amperage Draw)
Figure 2: Motor Efficiency Surface Plot for [Motor Name] (Efficiency vs. Amps vs. RPM)
Figure 3: Motor Efficiency Contour Plot for [Motor Name] (Amps vs. RPM)
Figure 4: Propeller Efficiency Curve for [Propeller Name] (RPM vs. Thrust vs. Airspeed)
Figure 5: [Motor Name] RPM Efficiency Curves (Efficiency vs. Airspeed)
FIgure 6: Efficiency Comparison of Propeller & Motor @ Cruising Speed (Efficiency vs. RPM)

Mreq
Mreq = [Drag Estimates, Mission Cruising AIrspeed]
Mreq{1} = [D1(n) M1s];
Mreq{2} = [D2(n) M2s];
Mreq{3} = [D3(n) M3s];

Output in Command Window
bestprops = [best_prop_name]
best_combo = [Mission 1-3 Optimized
bestprop
bestmotor
eta_net
amp_draw
eta_Prop
eta_Motor]

Propulsion_analysis_fun.m
MATLAB function responsible for analyzing Propeller and Motor Mission Performance. Selects the best propeller and motor for each mission.

Output in Command Window
M[1-3] = [Propeller name, Motor Name]