

Motor calculation test plan

Propulsion system simulation

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Table of content

[1. Aim & Hypothesis 2](#_Toc55301154)

[1.1. Aim 2](#_Toc55301155)

[1.2. Hypothesis 2](#_Toc55301156)

[2. Variables 2](#_Toc55301157)

[2.1. Inputs 2](#_Toc55301158)

[2.2. Outputs 2](#_Toc55301159)

[3. Tools 3](#_Toc55301160)

[4. Method 3](#_Toc55301161)

[4.1 Data collection 3](#_Toc55301162)

[4.2 Calculate current & efficiency 3](#_Toc55301163)

[4.3 Calculate torque 3](#_Toc55301164)

[4.4 Calculate output power 3](#_Toc55301165)

[4.5 Calculate rotation speed 3](#_Toc55301166)

[5.Expect result 4](#_Toc55301167)

# Aim & Hypothesis

## Aim

Establish a mathematical model for the relationship between the output and input of the motor

## Hypothesis

The output power, torque, rotation speed can be calculated by the input voltage.

# Variables

These are the constants and variables that will be used during the test.

|  |  |
| --- | --- |
| Constants simulation | Keep constant at... |
| Ambient temperature | Standard indoor temperature with lower and upper limits (20 ℃ ± 5℃). |
| Battery level computer | Constant power source. |
| All input variables | Real positive numbers & ISO-notation. |

## Inputs

The limits stated are the limits of the real world. If values out of this range are entered, the outputs will be unreliable.

|  |  |  |
| --- | --- | --- |
| Inputs | Value | Range |
| Motor input voltage |  | [0,48] [V] |
| Motor data array(U-I) | - | - |
| Motor data array(I-T) | - | - |
| Motor data array(U-E) |  | [0,1] |

## Outputs

These are the outputs that will be monitored and will be used to see variations or changes in the system.

|  |  |  |
| --- | --- | --- |
| Outputs | Value | Range |
| Motor power output |  | [0,8800] [w] |
| Motor torque output |  | [0,40] [Nm] |
| Motor rotation speed ouput |  | [0,2400] [rpm] |

# Tools

|  |  |
| --- | --- |
| Testing tools | Demand |
| Computer | Windows 10 compatible |
| Excel | Newest version |
| Keyboard | No limit |
| Mouse | No limit |
| Calculator | Basic calculator |
| Pen & Paper | Basic pen & paper |
| Ammeter | 0-200A |
| Voltmeter | 0-60V |

# Method

## 4.1 Data collection

Input different voltages to the motor and measure the input current and efficiency of the motor under different voltages. Collect ten sets of data respectively, make the U-I, U-, of the motor and find the approach line and expression of the curve.

## 4.2 Calculate current & efficiency

According to the expression of the U-I, U- approach line, the motor input current and motor efficiency corresponding to different input voltages can be calculated. By using the user's input voltage, the current and efficiency are calculated.

## 4.3 Build I-T curve

From the input voltage U and the U-Thrust diagram obtained through experiments on the ship, the thrust of the propeller at this time can be obtained. The speed at this time can be obtained by calculating the required thrust on the propeller. Use the speed to calculate the load torque at that time. And by measuring the current value at that moment.

## 4.4 Calculate output power

We can use input voltage and current to calculation input power because we get the efficiency of the motor under given voltage, we can easily calculate output power of the motor.

## 4.5 Calculate rotation speed from motor

T=torque [N\*m].

P=power [W].

n=rotation speed [rpm].

Since we calculated the output power and output torque in the previous steps, we can use the formula to calculate the output rotation speed.

# 5.Expect result

After the user collects data and enters it into the calculation chain, user enters the motor's input voltage, the motor's output power, torque and speed can be calculated.