openrocketengine Documentation

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May 30, 2020

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Getting Started

1.1 Designing a Rocket Engine

1.1.1 What does OpenRocketEngine Do?

OpenRocketEngine will perform some basic calculations for rocket thrust chamber designs. Additionally, it will be able to perform comparisions of different configurations.

This code was originally created with the intention of automating vehicle sizing trade studies.

1.1.2 Design Inputs

Note: The physics behind the parameters mentioned here are not discussed. For a discussion on the physics behind the code refer to literature or gbok-propulsion.

The inputs are classified as either required or optional.

- `name`: [str] The name of the engine; used for naming output files.
- `units`: [str] (SI or Imperial)
- `thrust`: [float] Engine thrust (duh)
- `Tc`: [float] Chamber Temperature
- `pc`: [float] Chamber Pressure
- `pe`: [float] Exit Pressure
- `MR`: [float] Mixture Ratio $\frac{\dot{m}_{oxidizer}}{\dot{m}_{fuel}}$

1.1.3 Configuration Files

openrocketengine takes a configuration file as the only input, specifying the engine propellant properties, pressures desired, and geometric design choices. Right now, there is only one possible combination of parameters that all have to be included in the config file. In the future, there may be additional options to automatically retrieve propellant properties from CEA.

Config files are usually named with the engine name and the revision number with a '.cfg' suffix. I.e. RBF-rev01.cfg.

A typical configuration file looks like the following:

```
# This is a test configuration file for openrocketengine
#
# The parameters listed here are all the known parameters that openrocketengine can
↪take as inputs.
# Refer to the official documentation for more implementation and usage details.
name RBF1
units SI
thrust 5000
Tc 3200
pc 2068000
pe 101325
MR 2.1
MW 18.9
gamma 2.31
# Geometric parameters
lstar 1.016
area_ratio 5.5
```

1.1.4 Running the program

openrocketengine can be fun from the command line with the command *rocket*:

```
$ rocket RBF-rev01.cfg
```

1.1.5 Outputs

openrocketengine generates an output excel workbook with two sheets; one geometric parameters, and one for performance parameters.

1.1.6 Recommended Workflow

Create a directory for your enigne design files and run rocket from there. I.e.:

```
~/Documents/marginal-stability/engine/design$ rocket tsu-01.cfg
```

CHAPTER 2

Overview

OpenRocketEngine performs the calculations for simple analysis and design of rocket engines. For a general overview of the philosophy behind designing rocket engines, refer to the rocket propulsion section of General Body of Knowledge (GBOK).

CHAPTER 3

Installation

OpenRocketEngine only supports python 3.5 and above. Functionality with other python releases is untested and not guaranteed. Basic usage:

```
$ rocket config_file.cfg
```

Basic Usage

For basic usage, refer to **'getting_started'_**.

Note: checkout "Nomenclature" below if you are unsure about any of the variable used above

These input parameters are typical of what is used in industry design of rocket engines. If you are unfamiliar with this process, I recommend reading "Rocket Propulsion Elements" for basics, and "Mechanics and Thermodynamics of Propulsion" for a more rigorous mathematical overview.

To get these input parameters, you have essentially three options:

1. NASA CEA

1. free, but difficult to use

2. generally trust worthy data

2. Braeuing (http://www.braeunig.us/space/comb.htm)

1. super simple and fast

2. data is based on STANJAN (older version of CEA)

3. no access to actual data files, so plot interpretation can result in signifant errors

3. Testing

1. challenging, but fun

2. expensive and not really necessary given the resources above

Nomenclature

Tc : chamber temperature thrust : Thrust pc : chamber pressure pa : ambient pressure MR : propellant mixture ratio MW : propellant gas molecular weight gamma : ratio of coefficient of heats