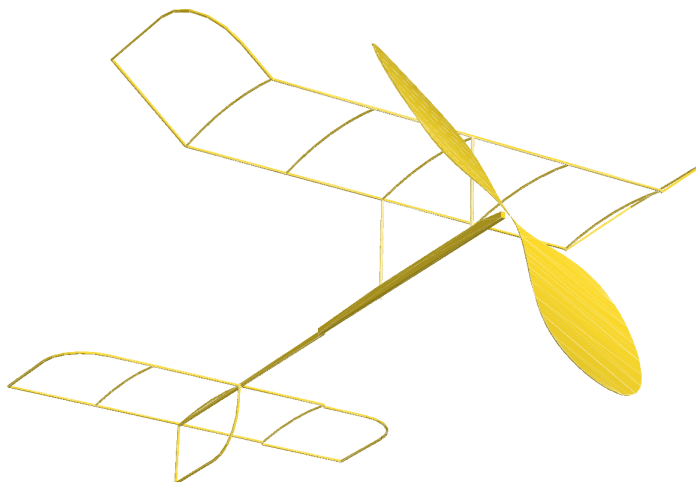# Predicting Indoor Model Flight Time with Python

Roie R. Black

January 10, 2022

1 Introduction

Indoor builders are always interested in finding ways to improve their model flight times. I started the *Math Magic* project (https://rblack42.github.io/math-magik) [2] in 2020 as part of my plan to build a Python application to assist model builders in designing and flying indoor model airplanes. The initial effort, published in the 2021 issue of the NFFS Symposium [1] focused on using *OpenSCAD* and some supporting Python code to design a model and analyze the proposed design to calculate weight and balance data. This article extends that project by providing a Python application that can help predict flight times of a model.

This article revisits work presented by Doug McLean in the 1976 issue of the NFFS Symposium [4]. McLean is a highly respected aeronautical engineer, and a retired Technical Fellow at Boeing where he worked for many years. He has authored a nice book titled *Understanding Aerodynamics* [5] which I am using as a reference for this project. My goal here is to provide better documentation on the theory behind Doug's scheme and Python code that implements his method. All of the theory and code is available in a more complete form on the companion website at **https://rblack42.github.io/math-magik-flight-time** [3]

Due to space limitations in the Symposium format, the code you see here is abbreviated. If you are interested in trying out the program I developed, I suggest that you download the complete code from the project web-

site at **https://rblack42.github.io/math-magic-flight-time/release.zip**.

2   Conclusion

I hope I have shown you that *OpenSCAD* can be a powerful tool to add to your building. Yes, it may get you involved with programming, but that is not necessarily bad, You might discover that all kids in school are learning how to program computers these days.

Using fee tools like this is a great way to get started down this path. MY hope is that I can add come more detailed analytical tools to my project to get a better feel for how well this craft will fly. I did get degrees in Aerospace Engineering, but that was a long time ago.

Have fun trying this out, and please visit the project website. All of the details I could not fit into this article will be there, and anything else I come up with in the future.

If you need help with any of this, you can contact me at roie.black@gmail.com. I always welcome feedback on my projects!

3   Biography

In the Summer of 1955 I was delivering the evening newspaper in Falls Church, Virginia, when I rounded the corner of an apartment building and saw a man release the propeller on a rubber-powered model airplane. The plane circled in front of this man's home for several minutes, and magically landed where it had started. The airplane was a Henderson Gadfly, published in Model Airplane News that year. I was fascinated by that sight, and decided to figure out how the airplane managed to do that. I talked the man into giving me the plans he used to build the model, traced from the magazine. I still has those plans to this day!) Soon, a couple of my friends and I decided to start building model airplanes of our own. We all took a bus to downtown Washington, D.C (kids could do that back then), and joined the Academy of Model Aeronautics. We also joined the *Fairfax Model Associates* and began competing in

a variety of events, mostly control line and gas free flight. At one meeting, Bill Bigge, an internationally known indoor model builder, was the guest speaker. I got my first look at a new form of model airplane. The indoor models Bill brought to the meeting were fascinating, and cheap enough even a kid with a limited allowance could build one. Bill became my mentor, and I managed to build an ornithopter and helicopter and set two national records! After almost getting a PhD in Aerospace Engineering from Virginia Tech, I spent 20 years as an officer in the USAF, then got a second Master's degree in Computer Science and spent another 17 years teaching college-level Computer Science. I finally retired for good in 2018, and moved with my wife to Kansas City, where I joined the *Heart of America Free Flight Association*, and again began flying model airplanes, this time focusing on rubber and electric powered outdoor free flight, and indoor events.When not building model airplanes, I am active in Amateur Radio and am currently authoring a book on Computer Architecture.

Contents

List of Figures

References

[1] R. Black. Designing an indoor model using openscad. *NFFS Symposium*, pages 65–84, 2021.

[2] R. R. Black. Designing indoor models using openscad, 2021. URL `https://rblack42.github.io/math-magik`.

[3] R. R. Black. Estimating indoor model flight times, 2021. URL `https://rblack42.github.io/math-magik-flight-time`.

[4] D. McLean. A method for predicting indoor model duration. *NFFS Symposium*, pages 54–60, 1976.

[5] D. McLean. *Understanding Aerodynamics*. John Wiley and Sons, Ltd, 2013.