Designing an Indoor Model using OpenSCAD

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Generating STL Files

Many folks who use OpenSCAD generate *STL* files from their design. These files are used as part of the 3D printing process. Although I wish we could 3D print flyable model airplanes, that is not what we will do with the STL files in this project.

STL stands for *Standard Tessellation Library* [1]. Translated, that means an STL file is a list of triangular objects that describe the surface of a 3D object. These triangles cover the surface making a "water tight" approximation to the real surface. Triangles are guaranteed to be flat in the 3D space, and if they are tiny enough, they can be rendered to create a 3D display of the object, or sent to a 3D printer after suitable processing of all the triangles so the printer knows where the surface is (that is a topic for another article!)

My purpose in introducing these triangles is simple. I want to know how much my model will weigh, and I want to know where the center of gravity will be when the design is constructed. Figuring out these two details is impossible using conventional building techniques: you build the model, weight it, anf figure out the center of gravity manually. Computer geeks never do anything manually if they can get their computer to do the work.

I found a nice Python library that is all set up to figure out the volume of a 3D shape defined in an STL file, and return it's center of gravity location. It is simple enough to add in the predicted wood density for the design and come up with a weight estimate for each part. A little post-processing of all this data will give us some estimate of the total designs weight. Unfortunately, figuring out the weight of the glue is not so simple. For that we need to know where each glue joint will be and the surface area of the glue joint. I am working on that problem now, but am not ready to show any results yet.

Knowing where each part will be placed in the final design, and the CG data for that part will let us predict the CG for the complete model as well!

1 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! I spent 20 years as an officer in the USAF, then 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.

References

[1] W. Authors. STL (file format) - Wikipedia, 2021. URL https://en.wikipedia.org/wiki/STL_(file_format).