User Manual for STL Slicer

Introduction

This STL Slicer is developed by Weizhuo Wang at University of Illinois at Urbana Champaign to aid the data processing of icing research conducted by Dr. Woodard. The primary purpose of this program is to compare and analyze two 3D files in STL format. To use this program, user must supply a clean airfoil STL (preferably as a sheet without holes) and a laser scanned model that can be roughly fitted with the clean airfoil.

This program has the following low level analyzing functionalities:

1. Stitch multiple STL into a single STL
2. Produce intersection slices between arbitrary plane (supplied in normal & point definition) and the STL model.
3. Smash 3D slice into 2D plane
4. Analyze line segments and combine them into multi segment lines.

Utilizing low level functions, the program provides high level analyzing functionalities such as:

1. Analyze horn height and horn angle by comparing two STLs
2. Periodic analysis of horn icing shapes
3. (Work in progress) Determine Maximum enclosed area curve from multiple slices

There are also multiple video tools that would help user change frame rate of the video and/or interpolate between frames to produce smoother video.

Directory Structure

Code files are all located in the src\ folder. Open any of the main script to run desired analysis. Libraries\ folder contains all the helper functions used in the program. Test\ folder is for debug purposes.

Folder data\ contains all the STL file. When user need to add new STL models, simply paste the folder that contains the model into data\ folder.

Folder results\ contains all the outputs from the slicer, including videos, processed videos, plots, raw data extraction etc.

How to use

1. Open src\ folder, depend on user needs, open corresponding script.
2. Modify the slicer setup part of the code.
   1. Define number of slices by modifying the tot\_idx variable
   2. Define each slice plane by modifying the for loop that defines p0\_total and n\_total
   3. Specify the STL for icing and clean configuration. If STL is separated in multiple parts, put them in order of root first tip last.
   4. Run the script

Specification on code

There are four scripts in the folder, each serve a specific function. Variables can be extracted from the Matlab workspace directly as CSV. The code also provides comments to point out what each part of code does.

*main\_icing\_angle.m* :

This script will slice the STL model, compare with corresponding clean slice and analyze the horn height and horn angle. It will plot the horn height and horn angle and save the plots to results\ folder. If needed, user can also produce a video of slices along the span.

*main\_maxArea.m* :

This script will slice the STL model and combine all slices into one single slice that encloses the maximum area. It is recommended that this script performed on slices that has similar thickness, or otherwise small ices that is not at the leading edge will not shown on the combined slice.

*main\_periodAnalysis.m* :

This script will slice the STL model only once along the leading edge. Then it will separate each cone shape and find center with respect to each of them. The segmentation process is a bit slow. Please be patient and not close the script.

*video\_tools.m* :

This script contains one demo on how to interact with video files in Matlab and two tools. For tools, one modifies the frame rate and the other one interpolate the video to make it smoother. Do not run the whole script as there are multiple tools in the script. User only need to run the desired part of the script.