

Introduction

Inserted in this email is a link to the source code for a piece of software written by a former teacher of ours. The code allows one to import and view STL files. It also contains data structures and functions to perform all manner of geometric manipulations and geometric analysis necessary for the subsequently described challenge. The goal is to implement code in the given code base that presents a specific visual result in the included viewer window. You will also find a sample stl file in the link as well.

The .stl file format is typically used in 3D printing applications. A description of the binary.stl file format can be found [here](#) for your reference.

Problem Description

For a given part model, there are three coordinate directions (x,y,z). Z, or the vertical direction, is of interest in this problem. It is important to identify the nature of the slope in the Z direction for a given part build in order to significantly speed up the build process.

Refer to Figure 1. If the slope in any portion of a slice is down-facing, we characterize the entire slice as "DOWN". Similarly, if the slope in the any portion of a slice is up-facing AND there is no down-facing portion, we characterize the entire slice as "UP". Finally, if the slope in the entire slice is vertical, we characterize the slice as "2.5D".

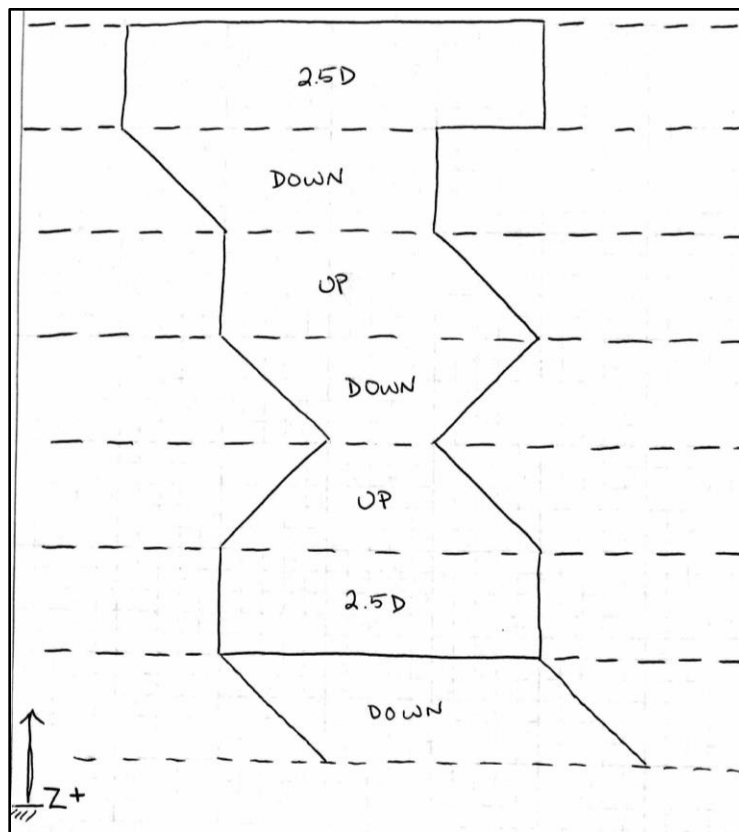


Figure 1: Description of types of surfaces.

Objective

Design and implement code that will identify UP, DOWN, and 2.5D slices in any imported .stl file. The result should be displayed visually in the viewer by color coding as follows (Figure 2):

- UP = RED
- DOWN = GREEN
- 2.5D = BLUE

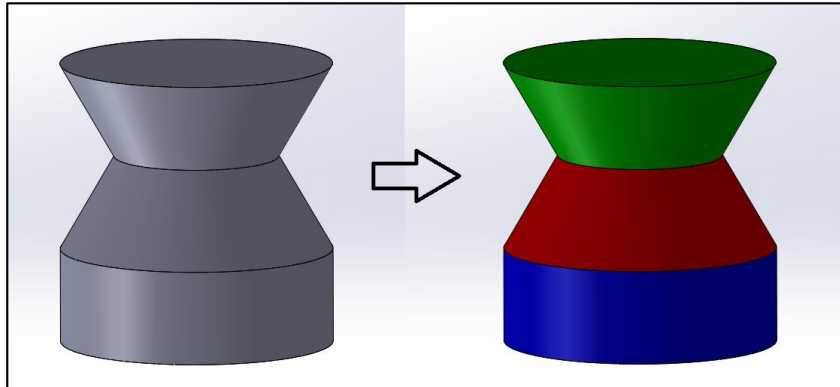


Figure 2: Example output.

Constraints:

- 100 um slice thickness

Evaluation

The 3DEO team will import various models to test the code. There should be a button to run the code block that implements the objective. Please also include a timer directly before implementation of the function (start at button click) and directly after the function exit with a textbox output directly below the button.