VRIJE
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PROPOSAL: PROJECT COMPUTATIONAL GEOMETRY

Approximating geometry

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Sciences and Bio-Engineering Sciences

1 Introduction

Our subject is about approximating geometric shapes with a set of convex hulls. The method we would like to study comes from the paper [Wei et al., 2022] which is used in software like `Box2D` to accelerate collision detection.

2 Proposed project

The project will be to implement the algorithms presented in the paper [Wei et al., 2022]. The first goal will be to transform a hardcoded 3D object into convex-hulls using these techniques. Then we will import 3D files with more complex geometry, like print-in-place objects used in 3D printing to validate its correctness.

The application will be accompanied by some controls to influence the algorithm, and inspect the final object from several sides.

At first, we will not try to implement the collision part, as making sure that the approximating algorithm is correct seems to be more important. Later when we are confident that the approximating algorithm is consistent enough with what we expect when comparing with the source model, collision detection queries might be added to the GUI.

For this project we would like to implement it in `Processing`[1] as it will make it easier to work with without having to worry about the `JavaScript` engine being slow, and having easier access to accelerators like `OpenGL` (full version). Doing the project in Java allows us also to get up and running more quickly as our knowledge is better in this language.

We chose `Processing` to still be close to the exercises seen in class, and being able to use Java at the same time.

References

Wei, X., Liu, M., Ling, Z., & Su, H. (2022). Approximate convex decomposition for 3D meshes with collision-aware concavity and tree search. *ACM Transactions on Graphics*, *41*(4), 1–18. https://doi.org/10.1145/3528223.3530103

[1] https://processing.org/