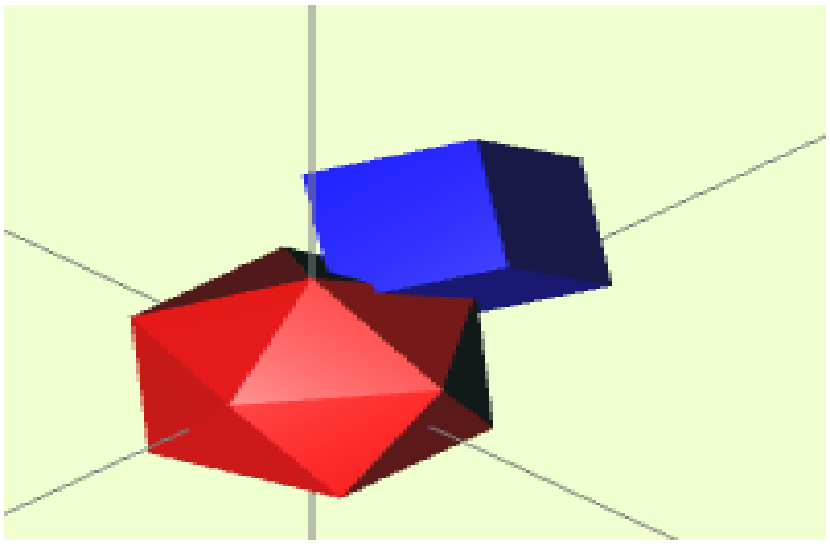
Assignment 2 – Mesh Collision detection

In this assignment you will implement a tool which efficiently detects collision between two 3D objects (represented by mesh)



Set up

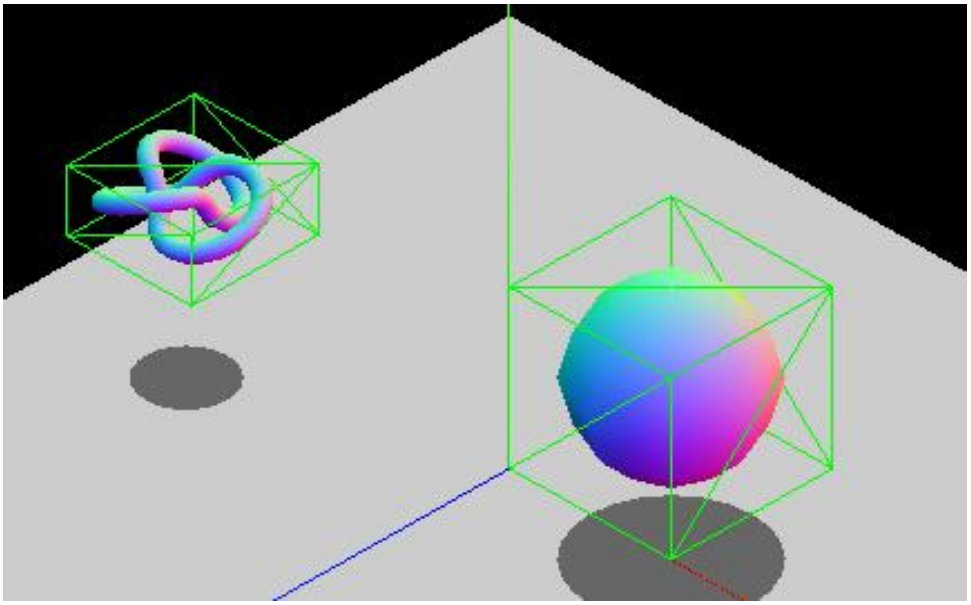
1. Read two objects from OBJ files and locate them so they don't intersect.
2. Use your mesh simplification program to save simplify mesh with at most 512 faces. (You can use Zachi's and Sagi's code for mesh simplification)
3. Give one of the object initial velocity in a certain direction which can be changed using the arrows.

Data base

4. KD-tree – for each object (shape/mesh) create a kd-tree: each node represents an axis aligned plane in the local coordinate system, that pass through one vertex. Each leaf represents a vertex of the shape mesh. You may choose to extend the code of the simple kd-tree from the site.
5. The KD-tree leaves contain the vertices of the simplify mesh (512 faces)

Algorithm implementation

6. Use kd-tree to implement Bounding Volume Hierarchy between the two objects in each frame. In each step find the relevant bounding box to check based on the previous step.
7. Bounding box will represent by the center and distance along each axis to box faces (see obb_sat.pdf). If any of the 15 axes separates the two boxes over the entire time interval (between two frames), then no intersection occurs. If you get no separation project the boxes on a plane perpendicular to the velocity vector.
8. During whole simulation you have to render:
   a. Two objects (one is moving) full mesh representation
   b. The biggest bounding box of each object.
9. When collide stop the moving object and show the smallest bounding boxes which collide, at least one of them.



10. Remember that the movement direction (of the moving object) can be changed using the arrows.
11. **Bonus (10 points)**: Use SVD of Eigen library (see code example) to find the best coordinate system so the largest OBB will be as tight as possible. The smaller OBB in the hierarchy will be axis align in the new coordinate system.
12. **Submission in pairs to the submission system. You can submit your whole project (recommended) or only the files you change or add.**
13. You can find explanation for OBB separation on the course site at lecture notes.

Good Luck!