

Test-Scenario: Menger Sponge

The goal of this assignment is to model a Menger sponge of iteration level 3 (see Figure 1f (2nd of the right)). You have a maximum of 30 minutes for the completion of this task, which consists of the following two subtasks:

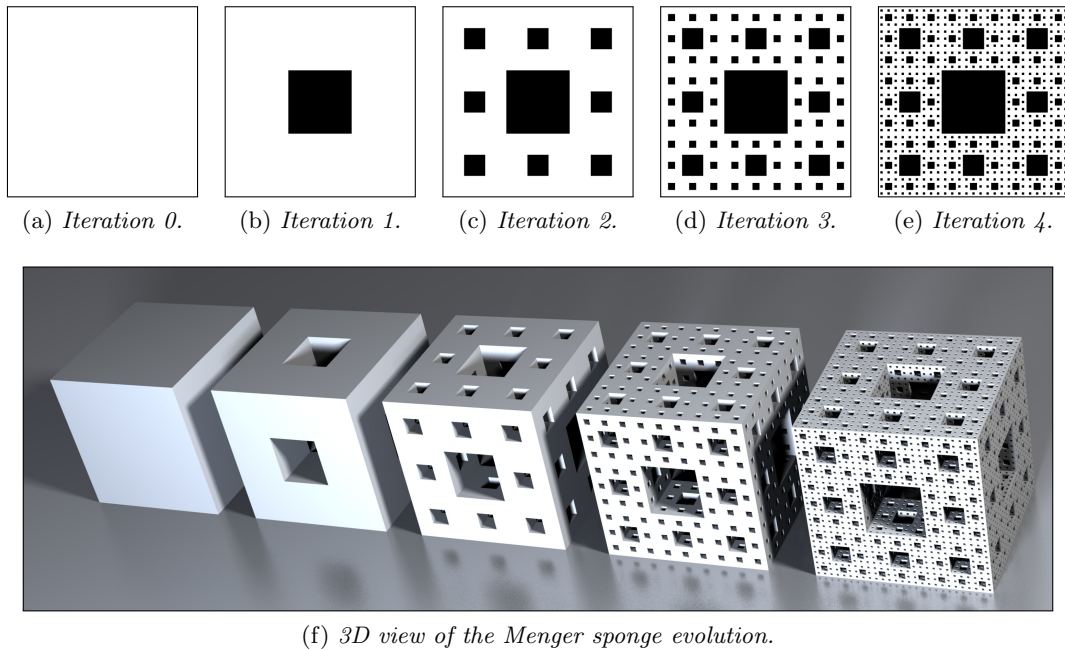


Figure 1: Evolution of the Menger sponge series in 2D und 3D.

A Sierpinski carpet (2D equivalent of a Menger sponge) is defined as a square, which is subdivided into 3×3 faces from which the one in the center is deleted. In the 3D case a cube instead of a square is used. This cube is subdivided into $3 \times 3 \times 3$ smaller cubes from which all cubes along the major axes through its center are deleted. Since a model is usually hollow on the inside, it is possible to define a different construction rule, which yields the same result. Instead of creating and deleting the smaller cubes it is possible to subdivide each side of the cube into 3×3 faces and then extrude the center face of all sides to a duct into the model. The different ducts each touch its neighboring ducts and therefore create a closed model.

Modeling the duct

A duct is modeled by subdividing a face into 3×3 faces and extruding the center face into to a height of $-1/3$ of the side length of the original face. This can be achieved by selecting the “limit to cube” option. Additionally, the top face of the duct needs to be removed to obtain the desired result (see Figure 2).

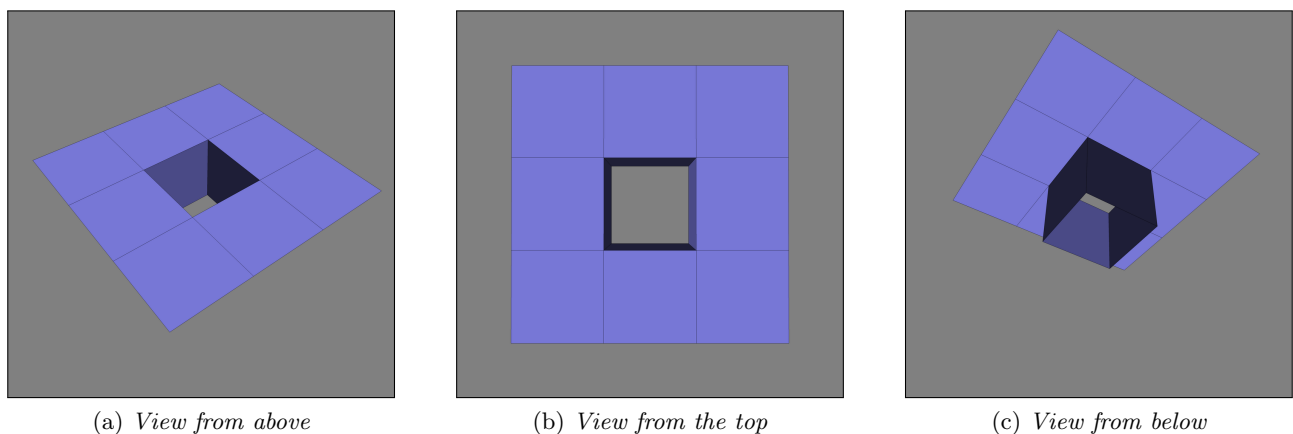


Figure 2: Different views of the basic recursion element of a Menger sponge.

Repeat the construction rule

After the construction rule is finished, apply three iterations to the rule to create a Menger sponge of level 3 (see Figure 1f (2nd of the right)).