

# Advanced Topics in Computer Graphics

Parameterization – theoretical exercise

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## 1 Question 1

You are given a patch (part of a mesh) that is homeomorphic to a disk, and some marked vertex (*pivot*) in this patch. The goal is to find a parameterization of the patch so that the distances from the pivot vertex to other vertices of the patch are well preserved. In other words, we attribute more importance to preservation of geodesic distances from the pivot vertex, than the rest of the patch vertices. Suggest a method to find such a parameterization.

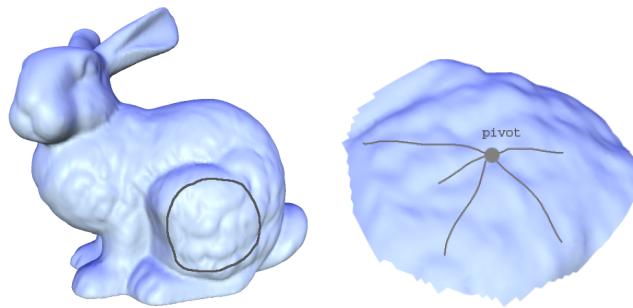


Figure 1: Illustration to Question 1. Left: the patch to be parameterized is highlighted. Right: we want to preserve the geodesic distances from the prescribed pivot vertex to all the others (so that the Euclidean distances in the parameter domain resemble the geodesic distances on the surface).

## 2 Question 2

We saw in class the greedy bounded-distortion parameterization method [1]. This technique grows one patch at a time and tries to make it as large as possible under the given distortion constraints. The disadvantage of such an approach is that it does not consider the remaining (non-parameterized) part of the mesh, which may lead to the following scenario: The first patch is very big, but the next ones are small “left-overs” that didn’t make it into the first big patch due to over-distortion or self-intersection. In addition, the presented method does not explicitly take care of the shape of the patch boundaries, which may lead to “jaggy” seams.

Suggest a way to improve this parameterization algorithm to (at least partially) solve the above problems. Try to think how to make the algorithm less greedy, while preserving its advantages (bounded distortion, no self-intersections).

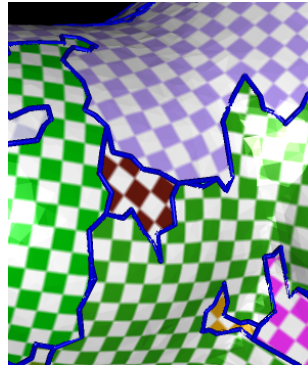


Figure 2: Illustration to Question 2. The lines denote the seams (boundaries between different patches). As you can see, sometimes the seams are “jaggy” (as opposed to straight and smooth). In addition, due to the greediness of the algorithm, some rather small patches are created after the big patches are finished.

## References

- [1] Olga Sorkine, Daniel Cohen-Or, Rony Goldenthal, and Dani Lischinski. Bounded-distortion piecewise mesh parameterization. In *Proceedings of IEEE Visualization '02*, pages 355–362, 2002.