# Practical Fabrication of Discrete Chebyshev Nets - Supplement

Hao-Yu Liu   Zhong-Yuan Liu   Zheng-Yu Zhao   Ligang Liu   Xiao-Ming Fu[†]

University of Science and Technology of China

1. Subdivision of rectangle patches

Although the motorcycle graph algorithm provides a rectangular partition, there are still some edges of tangential discontinuity. It is hard to deform a patch containing these edges inside to the target shape, so these edges should be on the boundary of the patches to lower the difficulty of fabrication. We detect such edges by evaluating the deviation of their adjacent edges from straight lines (i.e., $|\theta_1 + \theta_2 - \pi|$ or $|\theta_3 + \theta_4 - \pi|$, as shown in the right inset, is larger than a threshold). To get rid of the fragmentary results, we only retain the cases in which three or more continuous edges are connected in one direction. Then, we extend the two end vertices along the edge direction to reach the trails of the motorcycles.
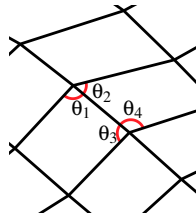
We will merge the small or narrow rectangles that are difficult to fabricate into adjacent patches in the next merging step as much as possible, where the small rectangles mean that the four sides of it are all not longer than two and the narrow rectangles mean that only two sides are no longer than two. For a small rectangle, if all of its four sides contain edges of tangential discontinuity, we choose a side with the fewest edges of tangential discontinuity and ignore the discontinuity of these edges in the next merging step. For a narrow rectangle, we split it from the middle if we can obtain two rectangles, and each of them has at least one side split from the longer sides of the narrow rectangle that contains no edges of tangential discontinuity. Otherwise, we also choose a longer side with fewer edges of tangential discontinuity, and ignore the discontinuity in the next merging step.

With these additional seams, a finer partition is acquired, and each patch is a rectangle (Fig. 11 (b)).

2. Comments in user study

- **Heart:** It is easy to deform and assemble the patches according to the specification, but it needs more time to assemble the last patch.
- **Car:** The fabrication steps are clear and simple. The finally fabricated shape is very similar to the digital model. The finished product is very shocking and has obvious artistic effects. However, it is slightly difficult to assemble and deform near the singularities.
- **Fish:** I think the fabrication process is very interesting. It was a good practice. During the fabrication, people need to be patient, and the tangential deformations require more training. It takes a lot of energy.
- **Star:** The task is easy in terms of handcrafting, and the final net is highly similar to the digital model. It was a fun and fulfilling experience.
- **Mask:** The quality of the resulting net is satisfactory, but my hands were hurt by wires during the manufacturing process. That was depressing. If some material can avoid this injury, I think the experience would be better.
- **Bird:** The fabrication method is simple and easy to understand. The produced net is highly similar to the digital net. I enjoyed the fabrication process.
- **Lamp:** It is easy to handle the welded wire mesh and learn the fabrication method. I could independently complete the production of the work. The fabricated net and the digital net are very similar.
- **Bone:** The specifications are clear. The overall fabrication process is very interesting. After finishing the manufacturing, I have a great sense of accomplishment.