

New Cloth Modeling for Designing Dyed Patterns

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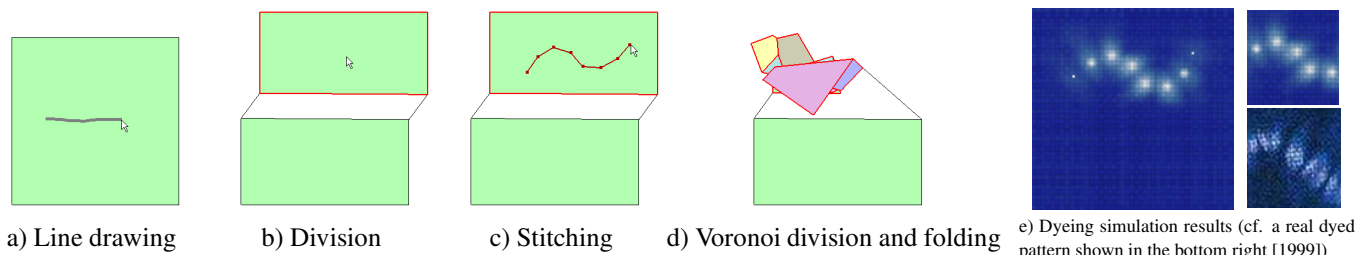


Figure 1: An example of our cloth modeling process applied to a local stitching operation. The model enables the application of multiple dyeing techniques onto a single cloth. We use an improved 3D dye transfer algorithm with this model to generate a dyed pattern.

1 Introduction

We propose a novel cloth modeling method to simulate dyeing techniques. Morimoto et al. [2007] proposed a physics-based dyeing simulation method. To simulate dyeing techniques in conjunction with folded 3D cloth geometries, we developed a natural and intuitive method to generate cloth geometries. This method uses locally applied geometric operations for multiple dyed patterns on a cloth and a Voronoi diagram based stitching algorithm for cloth gathering. It is not intuitive to generate some folded cloth geometries with one cloth, due to the requisite complexity of the cloth geometry. Instead, we implemented a novel sketch-based interface to divide a cloth patch for local geometric operation and for independent stitching operations. Our method provides an intuitive design platform for dyeing patterns.

2 Our system

Folding Cloth geometry is defined through simple, inelastic folding operations. First, we prepare a rectangle cloth patch consisting of four vertices. The user demarcates the cloth faces, and right clicks to indicate the region to be transformed. We use a symmetric transformation for a specified face and increment the z values of the vertices of the transformed face by 1 in the case of a valley fold. In case of ridge folds, we decrement the z values by 1.

Local operation In the case of local cloth modeling, the user specifies a face by a click left after division by line drawing (Fig. 1 (b)). Then both the specified face and the other faces are defined as local cloths. The local faces are connected by lines between corresponding vertices on the interface. The interface allows users to select, move, fold, and stitch local cloths using a mouse.

Stitching We simulate a simple running stitch on the cloth (Fig. 1 (c)), which is pulled tight to produce the distinctive pattern seen in Fig. 1 (e). Thread tension is critical to the dyeing process. The gather is approximated as folds whereas the folding lines are perpendicular bisectors between stitch holes. Pertaining to the interface, the user's line drawing defines the stitch holes (Fig. 1 (c)). We apply Voronoi division to generate divided faces from the stitching operation. Voronoi division is used to simultaneously calculate perpendicular bisectors and generate the folded faces. Then we con-

duct folding operations between every stitch hole in the order which they were drawn (Fig. 1 (d)).

Dye transfer The cloth model is dyed using a 3D model derived from the previous 2D model [2007]. We improve 2D dyeing model [2007] to simulate dye transferring in the folded 3D cloth geometry. Dip dye effects are added to calculate the distribution of dye supply in the dyebath. Users can assume direct control of the distribution of dye supply on the 3D cloth geometry, as the interface allows users to actively paint on the cloth dyeing simulation (Fig. 2 (a)).

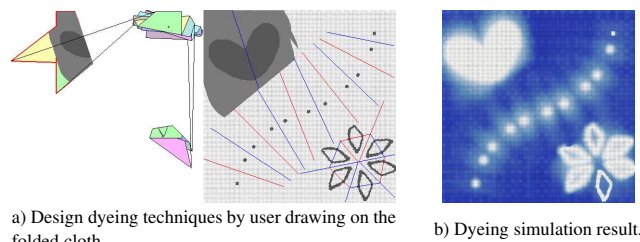


Figure 2: Our simulation result using three local cloths. In (a), light and dark gray denote covered and pressed regions, respectively. Red and blue represent ridge and valley lines.

3 Conclusion

We propose an effective cloth modeling method to design dyed patterns. Our method enables the simulation of multiple dyeing techniques on a cloth as well as the generation of stitched cloth geometries (Fig. 2 (b)). In the future, we would like to consider cloth elasticity, cloth thickness, curved folds, mixing colors, and automatic cloth divisions from a user's rough sketch.

References

- MORIMOTO, Y., TANAKA, M., TSURUNO, R., AND TOMIMATSU, K. 2007. Visualization of dyeing based on diffusion and adsorption theories. In *Proc. of Pacific Graphics*, IEEE Computer Society, 57–64.
- SAKAKIBARA, A. 1999. *Nihon Dento Shibori no Waza (Japanese Tie-dyeing Techniques)*. Shiko Sha (in Japanese).

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