A Procedural Modeling of Woven Textiles with Fuzz

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1 Introduction

The purpose of this article is to propose a procedure for generating woven textiles with fuzz through the modeling of surface staples. The procedure guarantees to control the appearance of fuzz. In woven textiles, fuzz is the result of staples untwisted from the yarns, as shown in Fig. 1(a). Staple is of average length in natural fiber (e.g. wool and cotton), but in silk or chemical fiber its length is shorter. Our modeling procedure also takes into account the arbitrary woven design which creates a quadrilateral mesh formed by warps and wefts, with the exception of gauze and leno weaves (twisting adjacent warps), as shown in Fig. 1 (b) and (c). The procedure improves the representation of woven textile.

Previous procedures (e.g. [Adabala and Magnenat-Thalmann 2003] and [Perlin 2002]) can also generate surfaces of woven textiles; however, these procedures cannot generate surfaces with fuzz.

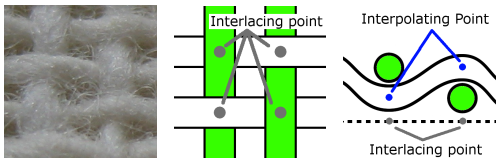

Figure 1: *Textile woven from spun yarn. (a) Picture of a fuzzy textile. Textile illustration (b) from top view and (c) from cross-section view. Green and white yarns signifies warp and weft. Interlacing points are placed in the plane represented with the broken line.*

2 Fuzzing Woven Textile Configuration

In order to represent fuzz, the procedure generates a woven textile from the overall region of staples, transforming some of the staples. The representation of the woven textile is produced in three steps as follows: The first step generates staples. The next step forms yarns from the generated staples, through a spinning transformation. The final step forms a woven textile from the generated yarns, through a weaving transformation. Fig. 2 illustrates each procedure. The procedure generates fuzz after the spinning and/or the weaving.

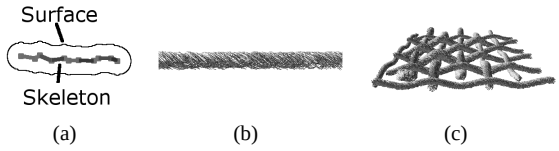

Figure 2: *Demonstration of the procedure. (a) A staple, (b) a yarn and (c) a woven textile.*

The staple is a surface represented by a function (a zero-set surface is determined by a predetermined radial distance for an established 'staple skeleton'), as shown in Fig. 2(a). The skeleton of the staple is represented by a polygonal chain. All vertices of the polygonal chains are transformed for forming the yarn and the woven textile.

The spinning process randomly places the staples into a boundary of a yarn and twists the staples around the axis of the boundary, as shown in Fig. 2(b). The procedure does not compute the intersection of the polygonal chains, because we assume that computing the intersection does not greatly improve the visual effect.

The weaving process prepares the interpolating points over the interlacing points on a grid as shown in Fig. 1 (b) and (c). The procedure places the yarns as wefts and warps, and transforms the yarns at the interpolating points as shown in Fig. 2(c).

For representing the fuzz, the polygonal chains at the yarn surface are transformed along random vectors in a specific range to control the fuzz quantity, after the spinning and/or the weaving simulation.

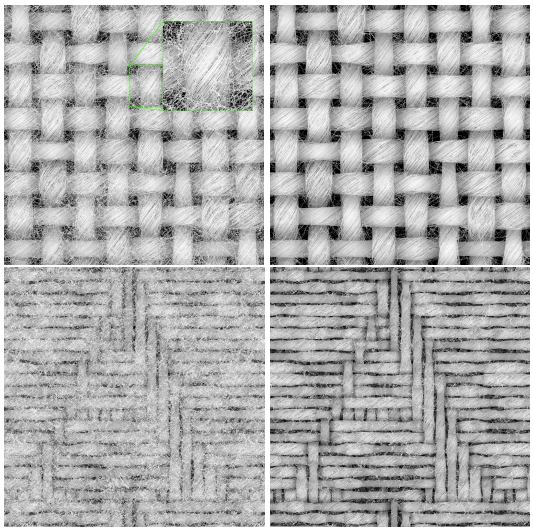

Figure 3: *Generated results. The left shows plentiful fuzz; The right shows lesser fuzz; The top shows a plane-weave; The bottom shows an 'Alphabet A' weaving design.*

3 Results

Fig. 3 shows height fields of woven textiles using the proposed procedure. The results shows that the procedure directly controls the appearance of fuzz on woven textiles; sets an arbitrary woven design; represents crimps for staples and the fuzz; and changes the form of the yarn by deforming its boundary.

References

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SIGGRAPH Asia 2009, Yokohama, Japan, December 16–19, 2009.
ISBN 978-1-60558-858-2/09/0012