# Procedural Approach for Realistic Woven Fabric Rendering

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**Abstract**

*We present a new procedural method for photorealistic rendering of woven fabric material. The goal of our research is to provide a new procedural method that renders photorealistic woven fabric without any measured data. The proposed method models the reflectance properties of woven fabric with alternating anisotropy and yarn-level surface normal manipulation. The experimental results show the proposed method can be successfully applied to photorealistic rendering of diverse woven fabric materials.*

Categories and Subject Descriptors (according to ACM CCS): I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—Rendering, Global Illumination

## 1. Introduction

Fabric appearance is important in industrial applications of computer graphics in the textile, garment, and fabric care industries. There are two main types of fabrics namely, *knitwear* and *woven* fabrics. Our goal is to produce photorealistic images of woven fabrics without any material data such as the measured BRDFs (Fig. 1 (a)) or BTFs.

(a) Measured BRDF (34 Mb) (b) Our approach

**Figure 1:** *Comparison with the isotropic measured BRDF.*

**Measured data-based methods.** Sattler et al. measured, stored, and retrieved bidirectional texture function (BTF) data as needed to render clothes [SSK03]. Wang et al. introduced a method for the visual modeling of spatially-varying anisotropic reflectance using fabric data, such as satin and velvet captured from simple acquisition device [WZT*08]. However, these methods required a lot of time for material measurements and large storage space.

**Texel-based methods.** Xu et al. introduced the idea to define a volumetric structure specifically for yarn called the *lumislice* [XCL*01]. However, these methods cannot be applied to woven fabrics due to the different characteristics of threads and weave pattern.

**Weave pattern-based methods.** Adabala et al. presented a technique based on a microfacet model and procedural textures that is capable of rendering fabrics with a variety of weave patterns at different level of detail [AMTF03]. Unfortunately, this method focuses on variety of weave patterns and treated the light reflection on the yarn surface somewhat lightly. In this paper, we present a procedural approach for realistic woven fabric rendering with alternating anisotropy and yarn-level surface normal manipulation.

## 2. Algorithm Overview

Woven fabric is constructed by interlacing two sets of parallel threads, known as *warp* and *weft*. Each weave element is a building block of woven fabric, and both weft yarn and warp yarn are included in each element. The pattern in which the warp and weft are interleaved varies greatly, but the majority of woven fabrics are made in one of the three simplest weave patterns: *plain*, *twill* and *satin* weave. In our work, we deal with those weave patterns for realistic fabric rendering.

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