1 Introduction

The need for rendering woven fabrics arises frequently in computer graphics [Neeharika Adabala, Nadia Magnenat-Thalmann, Guangzheng Fei 2003]. Woven fabrics have a specific appearance, luster, and transparency. A BRDF model is well known as the basic technology employed for expressing the appearance of a woven fabric. In order to represent the transparency of a woven fabric, a BTDF (bidirectional transmittance distribution function) model is required in addition to the BRDF model. In this paper, we propose two rendering methods for woven fabrics, particularly transparent fabrics such as lace, based on a BTDF model.

2 Measurement of woven cloth

We measured the BTDF of the two woven fabrics by using a BRDF instrument (OGM-3, DFL), which consists of a fixed digital camera, a movable light source (metal halide), and a movable sample plate. 2400 points per cloth were measured by repositioning the lamp and the plate. As shown in Figure 1, we made the following observations: (1) a woven fabric has the property of bidirectional transmittance and scattering and (2) transmitted light consists of two components—diffusional and directional transmission.

3 BTDF model and parameters estimation

In order to express various types of woven fabrics, it is essential to use a standardized BTDF model that can compress the measurement data. We propose a standardized model consisting of two components—diffusional and directional transmission—that are defined by the Henyey-Greenstein function.

A method for the automatic estimation of parameters is required in order to apply the proposed model to the measurement data. We estimated the parameters by using the Levenberg-Marquardt algorithm (LMA), which is one of the optimization algorithms. A comparison between the measured BTDF and the result of fitting the BTDF model with the estimated parameters is illustrated in Figure 2. On comparing the results of the proposed model with the measured values, we found that the peak of the specular transmittance of the model was in agreement with the measured value, and the curve of the diffusive transmittance of the model also corresponded with the measured value.

4 Rendering with the modeled BTDF

The results of rendering based on the measured BTDF and the modeled BTDF are presented in Figure 3 and 4. Both the rendering

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References