BRDF Display (sap_0046)

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1 Introduction

We propose a BRDF display that reproduces the textures of a light field. Conventional displays are now high-definition (HD). HD-displays are ideal in terms of their excellent resolution. This, of course begs, the questions of whether resolution is the most important factor when judging the quality of a display? If we think of displays as optical reproducers of real objects or environments, it is important to reproduce the light transport of real objects or environments. If we think of light transport, resolution is only one of the parameters in representing light transport. A light field has four components: two parameters give positions and two parameters give directions of light transport.

2 BRDF Display

We developed a BRDF display based on an integral photography (IP) technique (Fig. 1). IP is an ideal method to reproduce a light field in real space using a micro lens array [Isaksen et al. 2000]. IP consists of a HD-display and a micro lens array. We developed an IP display that has an LCD panel [Koike et al. 2006]. The BRDF display we developed uses a new IP display and computer graphics techniques, which are described later. Normally, IP displays display autostereoscopic images that have the highest resolution near the display plane. Therefore, if we reduce the depth of information, we can increase the directional variation of images. Although we create a light field (s, t, uout, vout) using both a BRDF and a BTF, the actual pixels correspond to one lens and have same (s, t) coordinates.

Figure 2 shows the calculation method and image data that the BRDF display uses. For simplicity, we assume objects to have no textures and the same BRDF in any place in Fig. 2. Image data consists of an outgoing ray map (Rout), an incoming ray map (Rin), and a BRDF map (T). The first two maps are input parameters for the BRDF map. The outgoing ray map represents \( \omega_{out} = (u_{out}, v_{out}) = Rout(x, y) \). The (x, y) coordinates represent pixel positions on the HD panel. The incoming ray map represents the intensity and directions of input rays, \( \omega_{in} = Rin(s, t) \). The BRDF map represents the BRDF. It has six parameters. If the BRDF changes positions, more BRDF maps are needed. These maps are projected as 2D images based on the micro lens array layout. The intensity (I) of the BRDF display is calculated using the following functions.

\[
I(s, t, \omega_{in}, \omega_{in}) = T(s, t, \omega_{in}(u, v), \omega_{in}(s, t))
\]  

References


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