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Physically based optical parameter database obtained from real materials for real-time material rendering

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Abstract: In order to render objects in computer graphics and video games that closely resemble real objects, it is necessary to emulate the physical characteristics of the material and determine optical parameters consisting of an absorption coefficient and a scattering coefficient, which are measured from real objects. In this study, we propose a physically based rendering technique that enables real-time rendering by extracting the optical parameters required for rendering opaque and translucent materials and then collecting the obtained information in a database (DB). For this purpose, optical parameters were extracted from the high-dynamic-range image (HDRI) of an object, which was obtained using self-produced optical imaging equipment by taking images of its upper and lower parts. Furthermore, by binding the optical parameter with the texture of the corresponding material, 122 material-rendering DB sets were established. The validity of the proposed method was verified through the evaluation of the result by 118 users.

Keywords: Real-time rendering, Optical parameter, Material DB, Material rendering

1 Introduction

Owing to developments in the performance of game engines and graphics hardware, research on hyper-realistic rendering suitable for movie-like visuals in video games has been actively conducted in the field of computer graphics [1-4]. The existing material-rendering techniques that use simple textures have limitations in realistically expressing translucent materials; thus, a rendering technique that emulates physical characteristics is necessary [5-8].

Light is reflected from a material when a light source approaches the material, and the color is determined by the wavelength of reflected light. The rendering equation of this process can be used to calculate the color value of the pixels of the scene eventually observed. In consideration of the position and color of the light source, the observed color is determined by a combination of optical parameters (i.e., absorption coefficient, scattering coefficient, and refractive index) of the expressed material and albedo colors [9-11]. However, most of the existing material-rendering methods focus on the theoretical approach, and

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