Dealing with Optical Material Properties in Computer Graphics and Vision

Reinhard Klein

Bonn University, Bonn
Germany

ABSTRACT

In the area of shape recognition tremendous advances were made during recent years. But in contrast to this success the recognition of materials is still a big challenge although for humans the identification of differnt materials is normally an easy task. In Computer Graphics we face a similar situation. While the modeling of shapes is already a highly-developed area the realistic modeling of the interaction of light with objects, i.e. the modeling of optical material properties, is still a great challenge. In addition, while there are straight forward techniques to measure differences between two shapes we need more sophisticated methods to judge the difference of reflection properties. From the rendering point of view these methods might even contain perceptual components.

One way to obtain realistic reflection properties are measurements of real world surfaces. For arbitrary (non-fluorescent, non-phosphorescent) materials, the reflection properties can be described by the 8D reflectance field of the surface, also called BSSRDF. Since densely sampling an 8D function is currently not practical various acquisition methods have been proposed which reduce the number of dimensions by restricting the acquisition to specific classes of materials. A subsequent data modeling step is performed to interpolate missing values and compress the measured data further.

In the first part of this talk we will give a brief overview over the different measurement techniques and algorithms used to capture reflection properties of different classes of objects targeted to the specific needs of computer graphics applications. Special emphasis will be given to surfaces with complex meso-structure.

In the second part we will discuss some techniques we used for the validation of the measurements and the resulting renderings. Strength and limitations of different aquisition and validation techniques will be discussed and future challenges will be identified.