ABSTRACT

AN EFFICIENT MODEL FOR SUBSURFACE SCATTERING IN TRANSLUCENT MATERIALS

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In this thesis, we review subsurface scattering models used for representing subsurface scattering light transport effects in translucent materials. In addition, we propose novel compact factored subsurface scattering representations for measured subsurface scattering data.

Subsurface scattering effects in translucent materials are represented by the multidimensional Bidirectional Scattering Surface Reflectance Distribution Function (BSSRDF). By exploiting the diffusion property of multiple scattering in optically thick materials, these eight dimensional (8D) BSSRDF can be reduced to a four dimensional (4D) function. To compactly represent tabulated measured 4D BSSRDFs and achieve accurate approximations, we used factorization based techniques, such as Tucker and Singular Value Decomposition (SVD). We showed that the proposed factored subsurface scattering models provide high compression ratio while maintaining visual fidelity.

To validate the performance of the proposed factored subsurface scattering models, extensive comparisons are carried out using measured heterogeneous subsurface scattering data sets.

Keywords: Bidirectional Scattering Surface Reflectance Distribution Function, BSSRDF, Subsurface Scattering Model, Factorization, Heterogeneous Subsurface Scattering.