System and Methods for Real-Time Graphical Rendering of Dynamic Realistic Lighting

Advantages
- Facilitates computer graphical renderings with realistic lighting
- Facilitates dynamic rendering of glossy objects
- Fast and efficient algorithm which can determine the integral of the product of the various functions utilized to render the 3-dimensional lighting environment

Invention
A system and method that can quickly and interactively render dynamic, high glossy objects with realistic lighting. The technology uses a variation of the PRT model called just in time radiance transfer (JRT), which accelerates shadow computation in real-time.

Background
The design of light transport models that efficiently and realistically creates a 3-dimensional scene is a continuous challenge in the field of computer graphics rendering. Several methodologies have been developed to render such visually dynamic scenes (ray tracing, photon mapping and radiosity), all of which take so long to render, that they are inappropriate for interactive industrial design. Additionally, existing light transport models have a variety of limitations. Some require that objects in the scene be static, thus they cannot handle dynamic rendering. Other models cannot approximate the highlights created on glossy objects by high frequency lighting. An attempt to accelerate rendering processes has given rise to models that utilize a series of functions, their products and at times even their integrals. Sometimes, these functions are too complex or time consuming to solve, so simplified and approximated versions are utilized. However, such approximations tend to underestimate important variables within the scene rendering an environment which is unappealing and unrealistic. However, other more physically accurate lighting models are too slow for real-time rendering. A system called pre-computed radiance transfer (PRT) has been developed in order to render high glossy objects. However, this system does not handle interactive rendering of these objects with realistic all-frequency shadows.

UCF scientists have developed a fast and flexible system for creating computer-rendered scenes containing dynamic and realistic lighting. This system utilizes several functions which contribute to the light transport model of the scene. These functions include: a distant environment lighting function, a bidirectional reflectance distribution function (BRDF), a local visibility function and dynamic occlusion function. The result is a lighting system with real-time feedback capable of rendering realistic all-frequency shadows and glossy objects highlighted by high frequency illumination.

Application
The system can be used to render computer-generated scenes with glossy objects in real time. It can also be used in 3D-geometry modeling, industrial lighting design and for the real-time rendering of dynamic objects with realistic materials in computer games.

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Selected References


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