Advanced Graphics – Physically Based Rendering

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ABSTRACT

A video game without lighting is never going to look pretty and will rather look uninteresting. Real world lighting calculation are complex and expensive for video games to handle. Many modern video games make use of a lighting calculation technique called Physically Based Rendering (PBR) which mimics the real-world lighting in a digital world and makes it look realistic. PBR works on microfacet surface model, energy conversations and Bidirectional Reflective Distribution Function (BRDF) to make it happen.

This report explains the process to achieve the approximation of realistic views using PBR and future for the project in context of video game graphics.

**KEYWORDS**

PBR, BRDF, Lighting, Lights, Radiance, Billboards, HDR, Tone Mapping

**INTRODUCTION**

In computer graphics, lighting plays a huge role of making the player/viewer believe the realism of the virtual worlds. In old arcade style games like Pac-Man, Wolfenstein 3D, lighting was non-existent, and player can see the whole level or map even at huge distance. Even if expensive lighting algorithms existed, the CPUs of that era were not powerful enough to handle those lighting calculations in real time.

One of the greatest games of all time – Doom did show some sort of dynamic lighting although not realistic which is called Sector-based lighting. In Doom game, the world is divided into sectors which are made by connecting line segments to form a polygon. Every sector had different properties like floor, ceiling, texture and most importantly the light levels. Every sector had a light level ranging from 0-255 with 0 being dark and 255 being very bright.

Lighting attenuation computations were done such that the light travel from one sector to its adjacent sectors and based on the distance of how much it traveled, the light level of current sector will be slowly attenuated. It did support additional light sources like lamp for doing light computation for that sector and its adjacent.

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