Light Radiometry in Computer Graphics and application

Illuminating Virtual Worlds Efficiently.

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WHAT IS LIGHT?

Light is defined as an electromagnetic radiation. The visible light that
we see is only a tiny fraction of the electromagnetic spectrum, extending from very low frequency radio waves through microwaves,
infrared, visible and ultraviolet light to x-rays and ultra-energetic
gamma rays.

What is Light Radiometry?

Light Radiometry is the study of how radiation interacts with surfaces and objects. In computer graphics, it is used to model how light interacts with 3D objects to create realistic images.

Radiance is a measurement

Radiometric quantities are the backbone of light transport in Computer Graphics

BRDF

Bidirectional reflectance distribution function, used to calculate the reflection of light on surfaces

HDR

High dynamic range realistic images are used for lighting in CG, providing a more representation of light levels.

Light Radiometry in Graphics

Radiometry Measures Light Energy

The measurement of electromagnetic radiation in energy units is called radiometry, and it plays an important role in computer graphics and display technologies.

Radiometry Helps in Simulation

Radiometry is useful in simulating how light interacts with objects in a scene, which is essential for creating realistic computer graphics.

Radiometry Improves Image Quality

Radiometry helps in improving the quality of images by allowing us to measure the amount of light that is reflected, transmitted, and absorbed by objects in a scene.

Collaborative Research Projects

Radiometry plays a vital role in the development of collaborative research projects in computer graphics and applications.

Irradiance

Definition: Irradiance measures the power of light per unit area falling onto a surface. It's represented in Watts per square meter (W/m^2).

Roles in CGA:

- Shading and Rendering
- Realism in Images
- Surface Detailing

Light-Radiometry in Computer Graphics Timeline

Milestone 1: The Beginnings

In the early days, the foundational concepts of light and color in computer graphics were established, paving the way for future developments.

Milestone 2: The Ray Tracing Revolution

Revolutionary Ray Tracing Techniques in the 80s led to Photorealistic Version of Computer-Generated Images.

Milestone 3: Global Illumination

Advances in global illumination algorithms in the 1990s enabled the simulation of complex lighting effects like indirect illumination and soft shadows.

Milestone 4: Real-Time Rendering

With the arrival of modern graphics processing units (GPUs), real-time version of complex lighting scenes became possible in the early 2000s.

Radiant Energy

Radiant energy is essentially light. It's a type of electromagnetic radiation that can exist as both waves and particles, depending on how it's measured. When light travels through space, it carries energy along with it.

When light comes into contact with physical objects, its energy is transformed into another form. For instance, when a microwave oven heats up a glass of water, its microwave radiation is absorbed by the water molecules. In this scenario, the radiant energy of the microwaves is converted into thermal energy, also known as heat.

Radiant Flux (Radiant Power)

Light flows through space, and so radiant power is more commonly
referred to as the time rate of flow of radiant energy, or radiant flux .
It is given by, Radiant flux (power) = Radiant energy/time

Thank you for your attention, wishing you a great day!