

# Daylighting Design Tools - COMM 6965

## Assignment 1

Yu Sheng

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### 1 What did I find?

I have found some relevant papers and useful links on Radiosity, a very important Global Illumination algorithm.

Here are the papers and links:

1. The paper that firstly introduces Radiosity:  
"Modeling the interaction of light between diffuse surfaces", Goral, Torrance, Greenberg, & Battaile, SIGGRAPH 1984
2. A tutorial on Radiosity from SIGGRAPH:  
<http://www.siggraph.org/education/materials/HyperGraph/radiosity/radiosity.htm>
3. This page provides a general overview of lighting algorithms, along with some programming examples:  
<http://freespace.virgin.net/hugo.elias/radiosity/radiosity.htm>
4. Radiosity webpages from universities:  
CMU: <http://www.cs.cmu.edu/~radiosity/>  
UNC: <http://www.cs.unc.edu/~coombe/research/radiosity/>

### 2 Radiosity

Radiosity is a global illumination algorithm, which could increase the realism of any given image by a multitude. Global illumination try to overcome the



Figure 1: Glass scene rendered in POV-Ray, demonstrating radiosity, photons, focal blur, and other photorealistic capabilities.

problems brought by direct illumination, such as ray tracing. Ray tracing tends to simulate light reflecting from only one surface, while global illumination, such as Radiosity, simulates many reflections of light around a scene. It can give us a more realistic visual effect.

Radiosity has its basis in the field of thermal heat transfer. It was introduced in 1984 by researchers at Cornell University to be used in 3D graphics. It is now generally used in graphics engines, such as Newtek's Lightwave internal render engine, Lightscape (now incorporated into the Autodesk 3D Studio Max internal render engine), and Radiosity by Auto·Des·Sys. Figure 2 is an example demonstrating Radiosity, and other photorealistic capabilities.

### 3 Relationship with our seminar

Radiosity is a generally-used photorealistic graphics method, and could generate more realistic images. Associated with our seminar, it could be used as a fundamental algorithm in the daylighting simulation, which could provide some useful tools for architects in their designing procedure.

Working with these tools, architects might be able to view the direct visual effect about what the new building will be, and they can adjust their building model and design proposal in computer! It will save both money



Figure 2: Radiosity can serve as a basic algorithm in designing tools for architects.

and time.

## 4 My proposal for this semester

I am just starting to learn about Radiosity. My proposal for this semester comes as follows:

1. Implement Radiosity on current system. I am now working on a day-lighting simulation system based on direct illumination. It could generate simple shadow and lighting effect. The next step would be adding Radiosity algorithm to the system to generate more fancy visual effect.
2. Real-time rendering. A disadvantage of Radiosity is that the rendering procedure might be slow. So after implementing is on my system, I will work on improving the rendering speed of current algorithm. Adapting it to graphics hardware might be a possible way.