

More Radiosity, Environment Mapping, and the Start of Texture Mapping

CS116B

Chris Pollett

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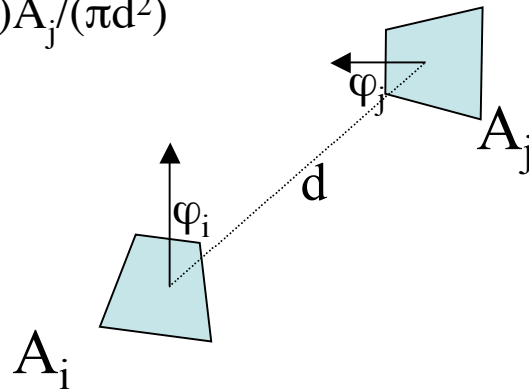
Outline

- More Radiosity
- Environment Mapping
- Texture Mapping

More Radiosity

- Last day, we gave a linear system of equations which, if we solved them, would give us the brightness of each patch in our scene according to our radiosity model.
- We still need to be able to solve these equations efficiently.
- We also still need to know how to figure out what the form factors are.
- We begin with the second of these two open issues. Look at the diagram below. $F_{i,j}$ can be approximated as:

$$(\cos \varphi_i) (\cos \varphi_j) A_j / (\pi d^2)$$



Yet More Radiosity

- Next, we also want to be able to avoid inverting matrices.
- To do this we take an approach called *progressive refinement*. (or Jacobi Iteration).
- Initially, we set each $B_k = E_k$.
- Then we iteratively update these values as in the following pseudo-code:

for each patch i

{

$$B_{\text{new}}[i] = E[i] + \sum_{j=1}^n m[i,j] * B[j];$$

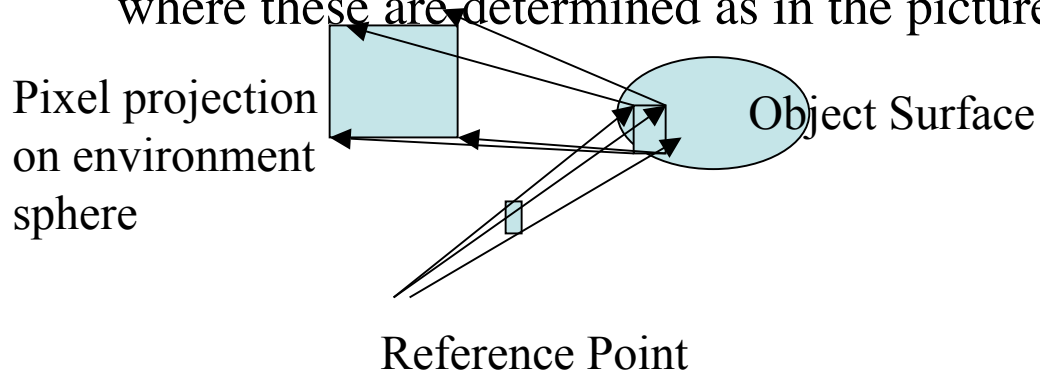
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Here $m[i,j]$ is the i,j th entry of our matrix M (form factor * reflectance) from last day.

- We keep applying the last step until the B_i 's converge enough.

Environment Mapping

- This is another approach to model reflections.
- It is also sometimes called *reflection mapping*.
- We put the environment into some bounding sphere. We imagine calculating the scene projected onto the interior of this sphere.
- When we want to calculate the intensity for a pixel viewed from a given perspective. We look at the average intensity of the region projected to in the environment according to reflection and refraction where these are determined as in the picture below.



Photon Mapping

- The idea of photon mapping is to ray trace from each light source to the various surfaces and store the results in a “photon map”.
- Point light sources are modeled as sending rays out in all possible directions.
- We generate more rays from brighter light sources.
- Distributed ray tracing is then done from the viewing position using the photon map to figure out how the scene should look.

Texture Mapping

- We want to begin describing techniques for adding details surface details such as graininess of wood,etc to an object.
- One technique to do this is called *texture mapping*.
- Can have 1D, 2D or 3D patterns and we want to map then on to surfaces or volumes in our scene.
- Will say more next day as well as see more people's ray tracing demo's.