Abstract of
Global Illumination using Photon Maps

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1 Main purpose

Ray tracing has been extended with Monte Carlo techniques, and radiosity has been extended with directional capabilities. But neither of them precludes the use of the other. Monte Carlo is very time-consuming and gives noisy results while radiosity is memory-consuming and cannot handle specular reflection properly. Ray tracing could render shadows since radiosity has problem at dis continuities. -¿ Using ray tracing to render caustics. -¿ Using ray tracing to render all diffuse reflections seen directly by the eye. Using radiosity to model soft indirect illumination. -¿ Intend to simplify the geometric model. So we intend to simplify the representation of the illumination instead of simplifying the geometry. The PHOTON MAP is used to [1]generate optimized sampling directions, [2]to reduce the number of shadow rays, [3]to render caustics, [4]to limit the number of reflections traced as the scene is rendered with distribution ray tracing.

2 Overview of the Method

The first pass is constructing the photon map by emitting photons from the light sources in the model and storing these in the photon map as they hit surfaces. Our motivation is to obtain a very flexible environment with a lot of useful information that can be applied in the rendering step. The use of photons allows us to estimate surface radiance at surfaces with arbitrary BRDF‘s. We use two different ways to use the information from the photon map during rendering—accurate way and approximate way. The accurate computation is applied at surfaced seen directly by the eye or via a few specular reflections. This computation is performed using importance sampling where the information about the incoming flux is integrated with the BRDF to provide optimized sampling directions. Using shadow photons to reduce the number of shadow rays. Using a separate caustics photon map to compute caustics. The approximate estimate is using for the rays that have several reflections to the final

pixel radiance, which implement as for all surfaces equals a radiance estimate obtained from the photon map.

3 Pass 1

Use two photon maps: A caustics photon map A global photon map The caustics photon map store photons corresponding to caustics and —— emitting photon towards the specular objects in the scene and storing these as they hit diffuse surfaces.

References

[1] Henrik Wann Jensen. *Global Illumination using Photon Maps*. 1996.
[1]