1 Introduction

Today, high dynamic range (HDR) imaging, image-based lighting (IBL) and special effects techniques are common features found in many non-real-time rendering systems (“offline renderers”). Although slowly being adopted by game developers, few real-time rendering tools provide a seamless integration and persistent use of these techniques throughout their systems.

In this poster, we present the integration of the aforementioned techniques into a real-time walk-through rendering software based on global illumination used mainly for architectural visualization. Since current graphics boards support floating-point framebuffers, physically based lighting information is preserved throughout the rendering pipeline to allow for photorealistic special effects that are applied in real-time.

2 Lighting

When visualizing an architectural scene realistic lighting is crucial in terms of a realistic perceptual experience. Important factors are physical accuracy, authenticity of the light sources and the applied light distribution technique. We cover these requirements by combining a physically based daylight model and image based lighting using HDR light probes with progressive refinement radiosity.

Regarding the fact, that scenes from architectural visualization can be very detailed and the calculation time is proportional to the number of samples per patch, effective optimizations techniques must be applied. We use importance driven sampling techniques [Ostromoukhov et al. 2004] and early sample rejection mechanisms that are especially tailored for architectural scenes, typically including both, indoor and outdoor environments.

3 Real-time Rendering

The other essential aspect in creating a photorealistic visualization is the integration of effects that compensate the limited capabilities of common display devices. We increase the level of depth perception by simulating the depth of field effect [Scheuermann 2004] in conjunction with automatic focus that is essential in the walk-through context. The main limitation when rendering HDR scenes is the insufficient dynamic range of the display device, implying a tone mapping to displayable brightness values. To solve this problem, we extended Reinhard’s photographic global operator [Reinhard et al. 2002] to respond dynamically to the amount of light in the current view as the user is moving through the virtual scene. To partly recreate the brightness impression of the HDR scene we implemented a glare simulation that is performed before the tone mapping process. All these viewpoint dependent effects are calculated using image processing methods and algorithms. To guarantee realtime performance, we take advantage of the enormous computing power of current graphics hardware by applying GPGPU techniques in our post-processing pipeline.

To further enhance the visual quality of architectural visualizations, a realistic simulation of surface materials is important. Therefore we provide techniques like parallax bump mapping, fresnel property, blurred dynamic HDR reflections and first-order refractions in our visualization system.

4 Conclusion

We presented a photorealistic rendering system for static scenes that can rival many “off-line renderers” in terms of quality while achieving real-time frame rates.

References

