

Brigade: Real-Time Photorealistic Rendering with GPU Path Tracing

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In pursuit of real-time photorealism, today's rasterized games require an ever-increasing amount of tricks and combination of hacks to achieve effects like soft shadows, ambient occlusion, non-planar reflections, and indirect lighting with diffuse interreflection. Adding new effects without breaking others makes the code extremely complex and difficult to maintain. Path tracing handles all these effects with a simple and elegant, physically based light-transport algorithm, which is suitable for parallelization and can render pristine photorealistic image quality using arbitrary BRDFs, which is impossible to achieve with rasterization. Until recently, path tracing has been considered too computationally expensive for creating special effects in films and animations, let alone for real-time graphics applications. However, due to recent advancements in graphics hardware, including increased programmability and parallelism, the GPU is now able to accelerate path tracing by an order of magnitude compared to CPU path tracing. In some "ideal" scenarios (scenes with open environments lit by a skylight or large light sources with few indirect lights and simple materials) GPU-accelerated path tracing is now fast enough to converge at real-time frame rates, suitable for displaying dynamic scenes, which can be used to create photorealistic games, virtual walkthroughs, and simulations. The real-time path-traced images convey an unrivaled sense of realism with physically accurate reflections, refractions, soft shadows, caustics, and diffuse color bleeding. This demo shows how the Brigade path tracer achieves path-traced dynamic scenes in real time.