Packet-based Whitted and Distribution Ray Tracing

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ABSTRACT

Much progress has been made toward interactive ray tracing, but most research has focused specifically on ray casting. A common approach is to use "packets" of rays to amortize cost across sets of rays. Little is known about how well packet-based techniques will work for reflection and refraction rays, which do not share common origins, and often have less directional coherence than viewing and shadow rays. Since the primary advantage of ray tracing over rasterization is the computation of global effects, such as accurate reflection and refraction, this lack of knowledge should be corrected. Our ultimate goal is to achieve interactive distribution ray tracing with randomized rays for glossy reflections, soft shadows, motion blur and depth of field. But it is not clear that the randomization would not further erode the effectiveness of techniques used to accelerate ray casting. This paper addresses the question of whether packet-based ray algorithms can be effectively used for more than visibility computation. It is shown that with the appropriate choice of data structure and packet assembly algorithm, useful algorithms for ray casting do indeed extend to both Whitted-style and distribution ray tracing programs.