THE SUMMARY OF Ph. D. DISSERTATION

No. 1

Major Science for Open and Environmental Systems		SURNAME,Firstname NAKAMARU, Koji

Title

Ray Tracing for Massive Data

Abstract

Ray tracing is known to be a powerful, versatile rendering method. It is also known to require lengthy computation time, which has been greatly reduced by previous authors. Recent improvements also enable to efficiently capture complicated optical effects, which are difficult to handle with other methods.

There is, however, one serious problem with traditional ray tracing; the cost to access a scene database is not considered, so that accessing a scene with massive data may cause thrashing. Recent progress in modelling enables to create highly complex scenes and to aquire detailed geometry from the real world, thus the amount of data that users want to render increases rapidly. Traditional ray tracing does not fit for such requirements.

In this paper, we propose an efficient algorithm to realize ray tracing for massive data. The algorithm is based on breadth-first ray tracing, which forms a set of rays and compares each object in turn against this set. The concept of breadth-first ray tracing itself was previously proposed, but its efficient algorithm has not been known. We achieve the efficient algorithm by combining breadth-first ray tracing with various techniques, such as 'uniform spatial subdivision', 'bounding box hierarchy', and other new schemes to minimize accessing data on disk. The algorithm always keeps sequential access for data on disk, so that no thrashing occurs. Experimental analysis shows that the algorithm can efficiently handle any size of data. The algorithm makes it possible to render any complex scene by ray tracing.