Monte Carlo and Beyond

A short course on Quasi-Monte Carlo techniques for global illumination and radiative transport

Alexander Keller
Course Level : Advanced
Location: Powell-Booth 100

9:30 a.m. - 12:00 noon
July 30th thru August 3rd

Light transport simulation for a complex environment

Monte Carlo methods are based on probability theory and are realized by simulations of random numbers. Quasi-Monte Carlo algorithms are based on number theory and are realized by deterministic low discrepancy points. Using low discrepancy sampling in the right way yields much faster rendering algorithms.

This course presents new and strikingly simple algorithms for the efficient generation of deterministic and randomized low discrepancy point sets, introduces the principles of quasi-Monte Carlo integration and Monte Carlo extensions of quasi-Monte Carlo algorithms, and finally provides practical insight by example hard- and software rendering algorithms that benefit from low discrepancy sampling.

This course is accessible to an audience with a principal understanding of basic ideas of Monte Carlo soft- and hardware rendering algorithms. The tutorial will teach the following topics: The concept of low discrepancy sampling, quasi-Monte Carlo integration techniques, Monte Carlo extensions of quasi-Monte Carlo integration, beneficial applications of deterministic and randomized low discrepancy sampling to hard- and software rendering algorithms. Participants in this course will learn how to construct simpler and much faster rendering algorithms by using number theoretic sampling methods. The course provides the simple algorithms, insight into the theory underneath, and gives application examples for hard- and software rendering.

The course schedule is as follows

Lecture 1 : Random Sampling and Monte Carlo Integration
Lecture 2 : Low Discrepancy Sampling
Lecture 3 : Deterministic Sampling Quasi-Monte Carlo Integration
Lecture 4 : Monte Carlo Extensions of Quasi-Monte Carlo
Lecture 5 : Applications (to Computer Graphics)

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