Proceedings of the 9th International Symposium on Radiative Transfer, RAD-19
June 3-7, 2019, Athens, Greece

RAD-19 CS01

A PHOTON MONTE CARLO SOLVER UTILIZING A LOW DISCREPANCY SEQUENCE FOR THERMAL RADIATION IN COMBUSTION SYSTEMS

Joseph A. Farmer and Somesh Roy*

Marquette University, Milwaukee, WI, USA.

ABSTRACT. Monte Carlo-based radiation solvers can provide an accurate solution to thermal radiation transfer in nongray participating media. Unfortunately, the computational cost of Monte Carlo solvers is an impediment to their use in large-scale simulations. A deterministic sampling-based-quasi-Monte Carlo (QMC) method is proposed in this work as an efficient alternative to conventional Monte Carlo solvers. This QMC uses a low discrepancy sequence instead of random sampling required in Monte Carlo-based approaches. The implementation is validated in one-dimensional configurations and is further tested in three-dimensional nonhomogeneous configurations. QMC shows generally better error convergence rates. In three-dimensional cases QMC produces a similar level of error compared to a conventional Monte Carlo solver without having to run multiple statistical instances. This leads to significant computational cost benefits from QMC as seen in the Figure of Merit comparison between QMC and conventional Monte Carlo.