PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

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Review of 70 Years of Monte Carlo Development at Los Alamos: 1953 – 2023

Abstract

The invention of both the Monte Carlo neutron transport methods in 1947 and deterministic discrete ordinates Sn in 1953 were all made at Los Alamos just after the Manhattan Project. The creators of these methods were Drs. Stanislaw Ulam, John von Neumann, Robert Richtmyer, and Nicholas Metropolis. Monte Carlo methods for particle transport have been driving computational developments since the beginning of modern computers; this continues today. This paper describes the history and advances of Monte Carlo codes at Los Alamos from 1953 through the present-day premiere radiation particle transport code, MCNP®. Recent work has uncovered critical documents that provide insight to the development of today's codes. This work briefly summarizes the motivation and development of early simpler and more specialized Monte Carlo codes that were specifically developed and tightly constrained by computing hardware and programming languages available in the early days of high-performance computing in the 1950 through 1970's.

Dr. Avneet Sood has served in Los Alamos National Laboratory's nuclear weapons program since 2000 as a technical contributor, leader, and organizational manager. His recent decade years have been in a key leadership role responsible for approximately 50 technical staff, post docs, and graduate students involved with Monte Carlo radiation transport methods and code development (including MCNP) and variety of radiation transport applications. These applications involve applying radiation transport principles supporting the US nuclear emergency response, nuclear counter-terrorism, and nuclear non-proliferation efforts. He has helped produce several PhD students at five universities, post-doctoral student advisor, and is an adjunct professor of nuclear engineering. He serves as an academic reviewer to nuclear engineering departments and professional societies. He is currently a Senior Scientist at the laboratory