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Nuts and Bolts of Monte Carlo Neutron Transport: Overview of algorithms and architecture of SCONE Monte Carlo code

Abstract:
Over the last decade, the importance of the Monte Carlo as a neutron transport calculation method has greatly increased. A number of new codes has emerged, and the stochastic methodology is being applied to more and more areas previously reserved for deterministic methods both in academia and the industry. However, the proliferation of the use of the method was not followed by the corresponding awareness of its inherent problems and limitations among general user community. Phenomena such as neutron clustering, intergenerational correlations or fine details of thermal scattering are sometimes neglected or insufficiently addressed. A number of possible reasons for this state of affairs includes the high complexity of modern Monte Carlo codes, which obfuscates their inner workings, implicit assumptions and simplifications. In addition a detailed discussion of Monte Carlo neutron transport is absent from most standard nuclear engineering textbooks.

In order to address these issue a new object-oriented Monte Carlo transport code is being developed at the Cambridge University Engineering Department. It is called SCONE (**S**tochastic **C**alculator **O**f **N**eutron transport **E**quation) and in contrast to most codes its aim is to prioritise clarity and modifiability over performance. Thus it is expected it will be simple enough to be employed for teaching and prototyping of new approaches on realistic test cases.

This talk will discuss the lessons learned during the development of SCONE. It will outline a number of challenges faced by any Monte Carlo particle transport code and describe their solution in SCONE and other more established Monte Carlo codes. Furthermore, the architecture of SCONE and how it attempts to facilitate easy modification of the code will be presented to provide insight into the low level inner workings of a Monte Carlo code. Lastly, a number of significant, but sometimes neglected phenomena that can adversely impact the accuracy of Monte Carlo results will be discussed.

Serdecznie zapraszamy,
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