Automation of Step-Size Selection in EGS5-beta

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The transport mechanics algorithm in EGS5 allows for significantly longer electron transport step sizes (and hence shorter computation times) than those required in EGS4 to obtain similar accuracy in the simulation of identical problems. But as different classes of problems exhibit differing step-size dependencies in all condensed history Monte Carlo electron transport algorithms, selecting the proper electron step sizes to optimally exploit the speed advantages of EGS5 in all problems can be challenging for novice users. Thus, an empirical method was devised for the initial official release of EGS5-beta (August, 2005) to automatically optimize step-size selection based on a single, material-dependent input parameter related to the size of problem tally regions. For the more recent release of EGS5-beta (March, 2006), the earlier empirical method, based on energy deposition in the so-called "infinite broomstick" problem, was modified to provide higher accuracy convergence by considering the angular distributions of electrons emerging from the front faces of "finite broomsticks." Additionally, a numerical model for automatically selecting electron energy loss steps was developed and implemented. In this paper we review the general concepts which lead to step-size dependencies in condensed history electron transport algorithms, and we describe the empirical models for selecting optimal electron multiple scattering step sizes used in EGS5. We also examine the method used to determine electron energy loss step-sizes, and we conclude with a discussion of some relevant sample problems.