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Dr. Jeremy Roberts

Professor - ME 701

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Dear Dr. Roberts:

Please find enclosed my manuscript, “Review and Enhancement of Monte Carlo Foam Simulation Using Object Oriented Programming, and Message-Passing Interface”, which I would like to submit to you as part of the course requirements of ME 701.

This paper investigates the use of Monte Carlo simulation to predict the intrinsic thermal-neutron detection efficiency of porous media. Previous studies have shown the validity of such methods, but additional review of the simulation methods has suggested significant improvements are possible. The present work assessed the physical accuracy of the simulation environment, and re-designed the software using object-oriented practices to enhance flexibility and expand usability of the simulation. Additionally, message-passing interface (MPI) was utilized to reduce the execution time of the simulation.

Two significant physical flaws were discovered and corrected during this review, yielding a more reliable prediction of intrinsic thermal-neutron detection efficiency. The re-design using object-oriented practices enabled the development of numerous “preset foams” to be used, but also allows for the user to describe specific characteristics for optimization purposes. Finally, the use of MPI reduced the execution time for a characteristic problem (20cm thick, 100% Lithium-Fluoride impregnated foam using 105 histories) from 78 seconds to 17 seconds (using only 4 nodes).

I thank you for your consideration and look forward to your decision.

Sincerely,



Michael Reichenberger