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Final Report for LDRD13-0130: Exponentially Convergent Monte Carlo for Electron Transport

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Abstract

This is the final report on the LDRD, though the interested reader is referred to the ANS Transactions paper which more thoroughly documents the technical work of this project.

ACKNOWLEDGMENTS

The authors are grateful for the assistance of Jim Morel of Texas A&M University for prompting our interest in the residual Monte Carlo method and helpful discussions. Don Bruss worked on this project as a summer student and contributed extensively to the advances made in modeling anisotropic scattering with residual Monte Carlo. We gratefully acknowledge his efforts and enthusiasm. The authors would also like to thank Ron Kensek for many enlightening conversations during this project.

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CONTENTS

1. Description of the Project 7
2. References 8
Distribution 9

1. DESCRIPTION OF THE PROJECT

This project is best described in the ANS Transactions summary based on this work [1].

The computer code generated in this project has been captured under the git version control software in a repository. The repository is on the pegasus.sandia.gov machine under the directory /home/bcfrank/repos/ecode.git in a branch called ecmc.

In addition to the work described in the reference, efforts were made on several other fronts. Preliminary assessments were made of the effectiveness of providing an initial guess to the algorithm and using low-order calculations to provide an initial guess to higher order calculations (for example, using successively increasing numbers of discrete scattering angles to converge toward an analog solution or using a discrete scattering angle that successively approaches an angle cosine of 1.0 in order to converge toward the Fokker-Planck solution).

An effort was also made to numerically integrate a discrete scattering angle across the screened Rutherford scattering distribution. Late results indicate that this capability has been achieved. This capability makes it possible to use the ECMC approach with analog simulations and could be generalized to use the method with any arbitrary scattering distribution.

We hope to elaborate on these assessments and demonstrate the extensions to this work in future publications.

2. REFERENCES

1. B. C. Franke, D. E. Bruss, J. E. Morel, "Residual Monte Carlo with Discrete Scattering Angles in the 1-D Transport Equation," *Trans. Am. Nuc. Soc.*, **109** (2013). To appear. SAND2013-5504C.

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