

Vitaly Mogulian

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RESEARCH INTERESTS

Computational Mathematics Monte Carlo integration, variance reduction, Neumann-Ulam scheme, Sequential Monte Carlo
Programming Design of high-performance computational physics codes and computational algorithms, performance optimization of implementations
Applied Physics Neutral and charged particles transport, radiation shielding, radiotherapy, reactor physics

EDUCATION

IATE NRNU MEPhI 2005 – 2011
Engineer-physicist in nuclear reactors and power plants (Specialist diploma) *Obninsk, Russia*

- Three years long research work on variance reduction techniques for Monte Carlo gamma transport: design, implementation in the gamma part of the BRAND MC particle transport code, validation, and efficiency studies (Supervisor: Prof. P.A. Androsenko)
- Graduate Thesis title: «Development of the Monte Carlo method modifications for radiation shielding evaluations» (Supervisor: Prof. P.A. Androsenko)

EXPERIENCE

IATE NRNU MEPhI 2009 – 2013
Laboratory Assistant / Teaching Assistant *Obninsk, Russia*

- Assisting to computational equipment maintenance.
- Assisting to student programming courses teaching.

JSC «Engineering Center of Nuclear Containers» 2011 – 2021
Lead Modeling Engineer / Branch Chief *Obninsk, Russia*

- Providing physical simulations for the maintenance of spent fuel casks and other equipment design:
 - Fuel depletion and materials activation calculations including neutron transport modeling;
 - Radiation shielding evaluations using BRAND;
 - Criticality safety evaluations;
- Providing R&D on the described above fields for the equipment construction optimizations;
- Examination maintenance of the designed safety evaluations in Russian and Chinese regulatory authorities.

Independent Research 2011 – present
R&D of MC techniques for shielding *Obninsk, Russia / Tbilisi, Georgia*

- Development and maintenance as a pet-project of the BRAND code neutron and gamma parts (legacy codebase). A shielding calculation methodology [6] has been were designed, implemented and successfully used in engineering practice, which includes the following:
 - Variance reduction techniques for photon and neutron transport, such as exponential transform modification for convex shields, the coupled location-direction source importance sampling technique and Simplified Adaptive Splitting techniques.
 - Multi-Kernel Geometry Module for MC particle transport.
 - Some specific for equipment design process MC-techniques, such as multi-case computation techniques and automated producing spent fuel qualification tables scheme for cask.

- Investigations for novel promising MC-approaches (unpublished).
- Design of general-purpose automated adaptive variance reduction scheme and its implementation (unpublished).

OPEN SOURCE CONTRIBUTIONS

CMake	2022
Fixed the Fortran sources parser	
OpenMC	2025 – 2026
Preliminary contributions for the shielding methodology re-implementation	

TOOLS

<i>Programming languages</i>	Fortran (legacy and modern) – experienced; C, C++ – familiar
<i>Supplementary</i>	CMake, Git
<i>Physical codes</i>	SCALE (KENO, TRITON/KENO, TRITON/NEWT, etc.), BRAND
<i>OS</i>	Windows, Linux (Ubuntu)
<i>Language</i>	Russian, English

SELECTED PUBLICATIONS

- [1] P.A. Androsenko and V.G. Mogulian. “A modification of the Monte Carlo method based on combination the point and double point estimators (in Russian – Модификация метода Монте-Карло, основанная на комбинации локальной и двойной локальной оценок)”. In: *MEPhI-2010 scientific session proceedings 3* (2010), pp. 170–173.
- [2] P.A. Androsenko, A.V. Masterov, and V.G. Mogulian. “Usage of the BRAND program complex for optimization of a protective reload cask construction in terms of radiation safety (in Russian)”. In: *Proceedings of the XXII "Neutron physics problems of nuclear power (Neutronica-2011)" seminar* (2011).
- [3] P.A. Androsenko and V.G. Mogulian. “Non-analog simulation of particle scattering azimuth angle for solving radiation transport problems by the Monte Carlo method (in Russian)”. In: *In proceedings of Conference of Computational Mathematics CVM-2011, 29 June - 1 July, Akademgorodok, Novosibirsk, Russia* (2011). URL: http://www.nsc.ru/ws/show_abstract.dhtml?ru+220+16087.
- [4] V.G. Mogulian and T.V. Utyanskaya. “Estimation of allowed spent fuel parameters values range boundaries by usage of the BRAND post-processing module on the TUK-141 instance (in Russian)”. Presentation on the "Neutron physics problems of nuclear power (Neutronica-2016)" conference, Obninsk, Russia, 23–25 November. 2016.
- [5] V.G. Mogulian, M.V. Radchenko, and T.V. Utyanskaya. “Comparative analysis of calculated and measured dose rates as experimental loadings TUK-153 (in Russian)”. Presentation on the "Neutron physics problems of nuclear power (Neutronica-2018)" conference, Obninsk, Russia, 28–30 November. 2018.
- [6] V.G. Mogulian. *An approach to radiation shielding evaluations using estimators by expected scoring*. Aug. 2025. DOI: [10.5281/zenodo.16781416](https://doi.org/10.5281/zenodo.16781416). URL: <https://doi.org/10.5281/zenodo.16781416>.