

Special Issue on  
**Application of Computational Methods and  
 Mathematical Models in Nuclear Medicine and  
 Radiotherapy**

# CALL FOR PAPERS

Mathematical modelling has applications in important aspects of contemporary medicine, such as understanding, prediction, treatment, and data processing. It has been successfully applied to a number of important fields of medicine, including big data analysis, biofluids dynamics, cardiovascular diseases, clinical schedules and tests, drug design and discovery, epidemiology, genetics, image processing, immunology, instrumentation, microbiology, neuroscience, oncology, virology, and more.

Modelling and simulation in radiation related practices are becoming more and more popular, and various algorithms, code, and software have been developed. One such approach is the Monte Carlo method, which plays an increasingly important role in modelling the interaction of photons, electrons, positrons, and neutrons with the environment. In contrast to deterministic models, which solve the mathematical equations of radiation transport, Monte Carlo methods sample interactions as probability functions from cross-section data and physical concepts. The use of the Monte Carlo method for calculations in radiotherapy dosimetry has become the most efficient and consistent tool for simulations in most of the related fields, from basic dosimetric quantities to fully realistic simulations of clinical accelerators, detectors, and patient treatment planning. Monte Carlo allows for the performance of various virtual tests with water phantom and ion chamber models by using MCNP code (Monte Carlo N-Particle) and GEANT4 code (Geometry ANt Tracking), among others. The statistical Monte Carlo methods have been shown to provide the most accurate representation of dose distributions in the patient and phantom calculations.

The increasing use of Monte Carlo techniques in medicine is possible due to the progress of computer technology, as well as the computational power of contemporary computers. In addition, this progress also contributes to the application of other computational methods and mathematical models in medicine. Novel analytical and semianalytical computer techniques are used in the contemporary treatment planning systems, making it possible to perform accurate calculations of dose distributions in radiotherapy for complicated irradiation techniques such as IMRT (Intensity-Modulated Radiation Therapy) and VMAT (Volumetric-Modulated Arc Therapy), as well as calculations of radiation doses and various parameters in microdosimetry.

Various computational methods and mathematical modelling techniques have their place not only in radiotherapy, but also in nuclear medicine, and as such the aim of this special issue is to collate both original research and review articles, with a focus on the newest innovative applications of the computational methods and mathematical models in radiation medicine, diagnostics, and therapy.

Potential topics include but are not limited to the following:

- ▶ Progress in specialist software used for the radiation modelling in diagnostics and radiotherapy
- ▶ New solutions in treatment planning systems
- ▶ Modelling in microdosimetry
- ▶ Application of computational methods in the boron neutron capture therapy
- ▶ Modelling of nanoparticle-based radiosensitization enhancement in radiation therapy
- ▶ Monte Carlo evaluation of dose enhancement by cisplatin and other chemotherapy drugs
- ▶ New applications of the Monte Carlo methods in calculations of radiation transport in nuclear medicine and radiotherapy
- ▶ Computational methods and mathematical models in the carbon ion therapy
- ▶ Modelling of the skin radiotherapy
- ▶ Modelling of the total body irradiation technique
- ▶ Application of computational methods in radiosurgery of cancers
- ▶ Modelling of flattening filter free beams in telereadotherapy

Authors can submit their manuscripts through the Manuscript Tracking System at <https://mts.hindawi.com/submit/journals/cmmm/acmmm/>.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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