World Academy of Science, Engineering and Technology
International Journal of Nuclear and Quantum Engineering
Vol:17, No:01, 2023

Development and Verification of the Idom Shielding Optimization Tool

Authors : Omar Bouhassoun, Cristian Garrido, César Hueso

Abstract : The radiation shielding design is an optimization problem with multiple -constrained- objective functions (radiation dose, weight, price, etc.) that depend on several parameters (material, thickness, position, etc.). The classical approach for shielding design consists of a brute force trial-and-error process subject to previous designer experience. Therefore, the result is an empirical solution but not optimal, which can degrade the overall performance of the shielding. In order to automate the shielding design procedure, the IDOM Shielding Optimization Tool (ISOT) has been developed. This software combines optimization algorithms with the capabilities to read/write input files, run calculations, as well as parse output files for different radiation transport codes. In the first stage, the software was established to adjust the input files for two well-known Monte Carlo codes (MCNP and Serpent) and optimize the result (weight, volume, price, dose rate) using multi-objective genetic algorithms. Nevertheless, its modular implementation easily allows the inclusion of more radiation transport codes and optimization algorithms. The work related to the development of ISOT and its verification on a simple 3D multi-layer shielding problem using both MCNP and Serpent will be presented. ISOT looks very promising for achieving an optimal solution to complex shielding problems.

Keywords : optimization, shielding, nuclear, genetic algorithm
Conference Title : ICMNRNPS 2023 : International Conference on Marine Nuclear Reactors and Nuclear-Powered Ships
Conference Location : Rome, Italy
Conference Dates : January 16-17, 2023