科研动态

学科简介

科研成果

科研生产资质

科研动态

图片新闻

我校核能及应用团队（NEAL）在物理数学领域国际TOP期刊《Computer Physics Communications》上发表最新研究成果

2020年03月15日 陈珍平

我校核能及应用团队（NEAL）的陈珍平副教授、谢金森副教授和于涛教授在物理数学领域的国际TOP期刊《Computer Physics Communications》上发表题为《Multi-objectiveOptimizationStrategies forRadiationShieldingDesign withGeneticAlgorithm》的学术论文。该文章是我校核科学技术学院在《Computer Physics Communications》上发表的第二篇学术论文。

【“核”你一起谋发展】核院2021春季招聘之...

推荐阅读

教务办公室工作职责

2019年09月10日

学生工作办公室

2019年06月17日

党政办公室

2019年06月05日

Contents lists available at ScienceDirect

Computer Physics Communications

journal homepage: www.elsevier.com/locate/cpc

Multi-objective optimization strategies for radiation shielding design with genetic algorithm ☆

Zhenping Chen [a,c], Zhenyu Zhang [a,c], Jinsen Xie [a,c], Qian Guo [b,c,*], Tao Yu [a,c,**], Pengcheng Zhao [a,c], Zijing Liu [a,c], Chao Xie [b,c]

[a] School of Nuclear Science and Technology, University of South China, Hengyang, Hunan, 421001, China
[b] School of Resource Environment and Safety Engineering, University of South China, Hengyang, Hunan, 421001, China
[c] Hunan Engineering and Technology Research Center for Virtual Nuclear Reactor, Hengyang, Hunan, 421001, China

ARTICLE INFO

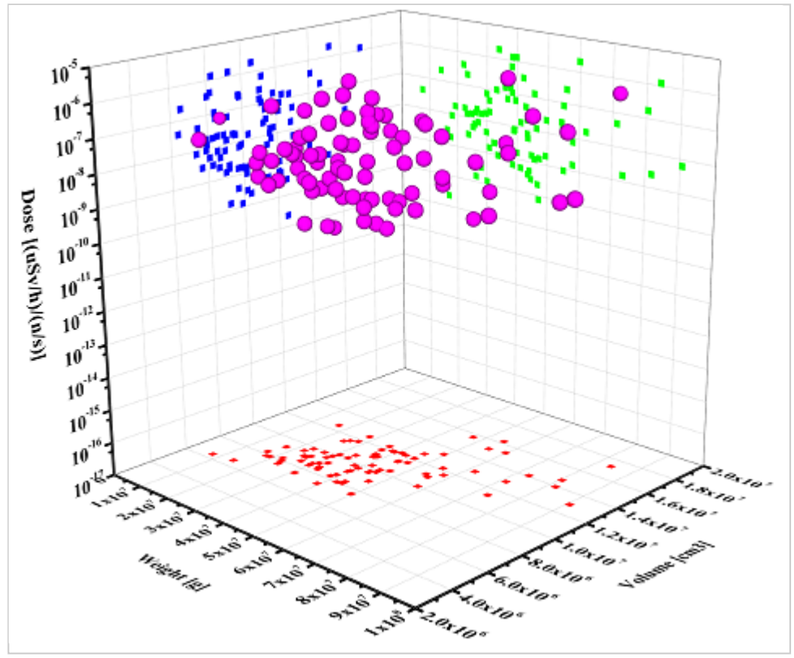
Article history:
Received 7 September 2019
Received in revised form 2 December 2019
Accepted 9 March 2020
Available online xxxx

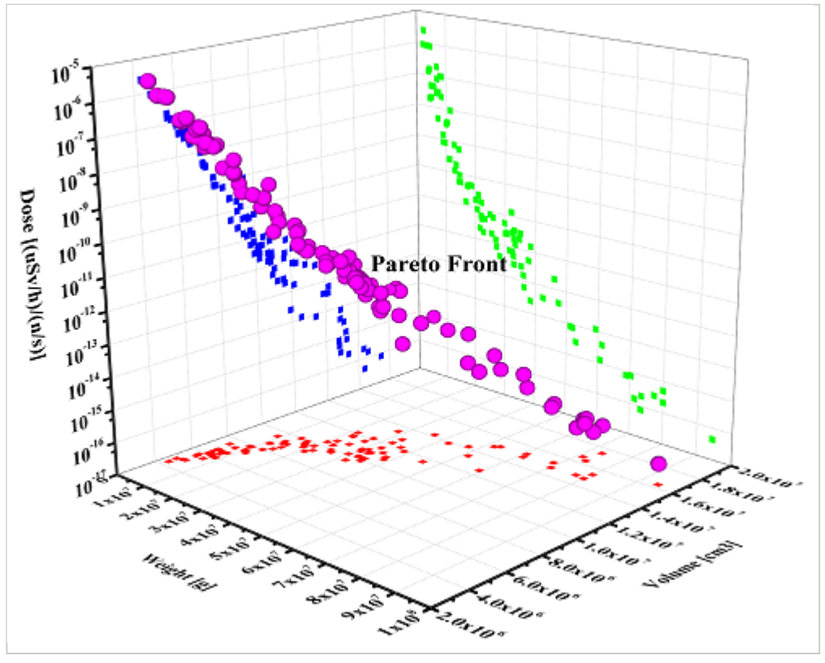
Keywords:
Multi-objective optimization
Evolutionary algorithm
Genetic algorithm
Radiation shielding design

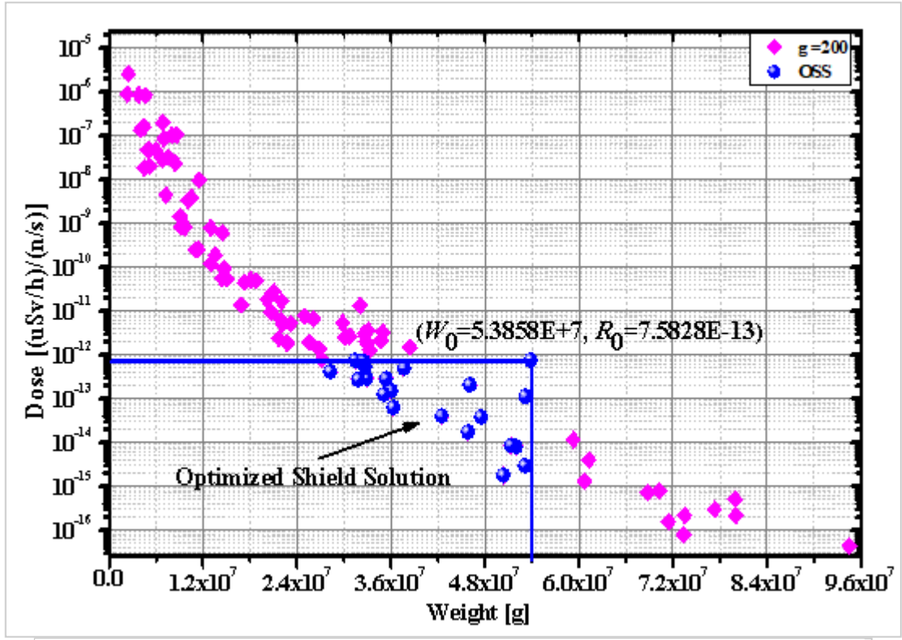
ABSTRACT

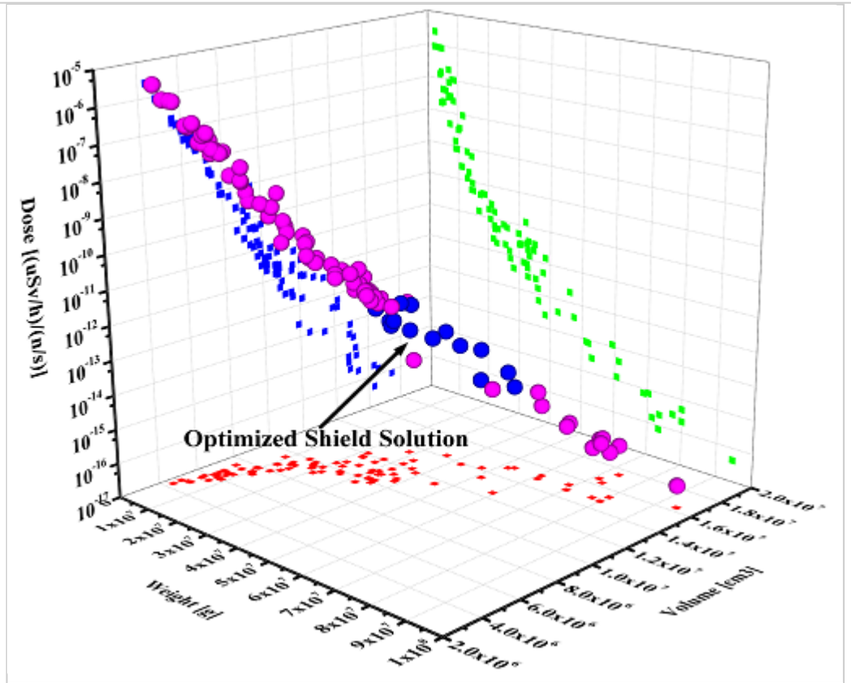
The radiation shielding design for advanced nuclear facilities is a typical complicated multi-objective and multi-parameter optimization problem in the nuclear engineering. To obtain an optimal solution of the shielding design is of significance in developing high-performance advanced nuclear facilities, especially for compact and mobile devices. The classical method of shielding design is a brute force trial-and-error procedure subjecting to human preferences and expectations, which is of failure to meet the requirements in radiation shielding optimization applications. Two multi-objective optimization strategies were developed to optimize the shielding structures and materials aiming at lightweight, compactness and low radiation dose under a set of constraints. The strategies employed an evolutionary algorithm, genetic algorithm, to perform radiation shielding design optimization efficiently and automatically. The most advantage of the strategies is that multiple optimal shield solutions could be achieved in one single simulation run, which will make the radiation shielding design procedure more efficient and flexible. The strategies were verified fully with a realistic multi-objective radiation shielding design problem. The numerical results showed that the strategies could balance well the shielding quality against the weight and the volume of the shield. It is confirmed that the strategies are applicable and effective for multi-objective and multi-parameter radiation shielding design optimization applications.

面向“海、陆、空、天”的新型核能装置是对传统核能技术领域的颠覆性创新，反应堆屏蔽优化设计是实现新型核能装置小型化、轻量化的关键。新型核能装置辐射屏蔽设计是一个复杂条件约束的多目标优化问题，该研究将传统辐射屏蔽理论与先进的AI算法相结合，提出了基于非支配理论多目标遗传算法的反应堆辐射屏蔽智能优化方法，实现了反应堆屏蔽关键设计参数智能协同优化，快速获得重量轻、体积小、防护代价低的全局最优设计方案。该研究对发展小型化、轻量化反应堆辐射屏蔽优化设计理论和设计方法具有重要的学术意义，对提升新型核能装置辐射屏蔽的设计性能与设计效率具有科学指导意义。


Dose [(uSv/h)/(n/s)]
Weight [g]
Volume [cm3]


Pareto Front
Dose [(uSv/h)/(n/s)]
Weight [g]
Volume [cm3]





该研究得到了国家自然科学基金（11605085，11705084）、国防科技工业核动力技术创新中心基金（HDLCXZX-2019-HD-34）和湖南省教育厅重点项目（19A422）的资助。《Computer Physics Communications》期刊是物理数学领域、计算机科学领域国际公认的顶级期刊。

文章链接：https://doi.org/10.1016/j.cpc.2020.107267

上一条：
疫情期间核科学技术学院青年教师刘敏在Dalton Transactions发表文章

下一条：

上海交通大学王德忠教授应邀来我院讲学

地址：湖南省衡阳市蒸湘区常胜西路28号

邮编：421001

联系方式：0734-8282251

官方微信

官方qq