Transactions of the Korean Nuclear Society Spring Meeting
Jeju, Korea, May 10-11, 2007

Development of EASYQAD version β: A Visualization Code System for QAD-CGGP-A Gamma and Neutron Shielding Calculation Code

Jae Cheon Kim[a], Hwan Soo Lee[b], Pham Nhu Viet Ha[b] , Soon Young Kim[a], Chang-ho Shin[a], and Jong Kyung Kim[b, *]
[a] *Innovative Technology Center for Radiation Safety, Hanyang Univ., Seoul, Korea*
[b] *Department of Nuclear Engineering, Hanyang Univ., Seoul, Korea*
[*] *E-mail: jkkim1@hanyang.ac.kr*

1. Introduction

EASYQAD had been previously developed by using MATLAB GUI (Graphical User Interface) in order to perform conveniently gamma and neutron shielding calculations at Hanyang University. It had been completed as version α of radiation shielding analysis code [3].

In this study, EASYQAD was upgraded to version β with many additional functions and more user-friendly graphical interfaces. For general users to run it on Windows XP environment without any MATLAB installation, this version was developed into a stand-alone code system.

2. Materials and Methods

The existing prototype of EASYQAD has 4 GUI modules: GEOMETRY, INPUT, OUTPUT and SHIELD as shown in Figure 1.

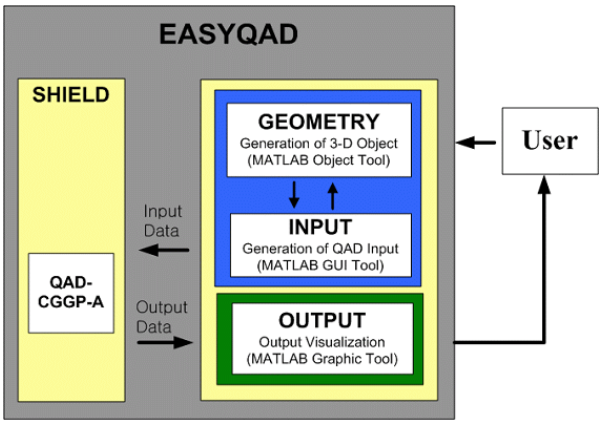

Figure 1. The structure and data flow of EASYQAD

The prototypal modules were firstly improved to satisfy more typical and complicated shielding calculations including overlapped geometry, geometry rotation, multi-group energy, source spectrum, source translation and rotation, neutron calculation, common material library and detector selection. After that, they were compiled in C++ programming language by using the MATLAB Compiler Toolbox to form a stand-alone code system that can be run on Windows XP operating system.

The specification of EASYQAD was summarized as in Table 1.

Table 1. EASYQAD and its specification

Contents	Specification
Operating System	Windows XP
Original Code System	QAD-CGGP-A (Version 95.2)
Programming Language	MATLAB R2006b
Version	β (stand-alone)

3. Results

EASYQAD version β was developed from its prototype by MATLAB R2006b in which many features and functions have been incorporated to provide the convenient environment to describe various geometrical shielding configurations.

At first, source option was reinforced with various functions. In more details, multi-group energy and neutron calculations were added as shown in Figure 2. Besides that, the source translation and rotation, and source spectrum functions were also added using the source input module.

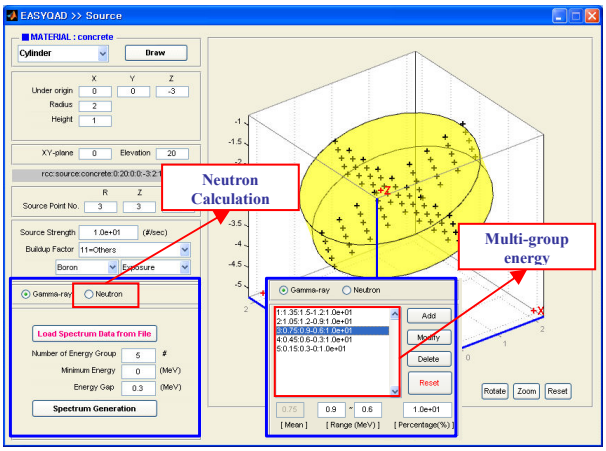

Figure 2. Source input module of EASYQAD

Then geometry functions were upgraded to perform geometry rotation and overlapped geometries. And EASYQAD were also developed to view easily 3-D scenes.

In addition, detector selections were extended to point, line, and grid shapes for convenient use as shown in Figure 3.

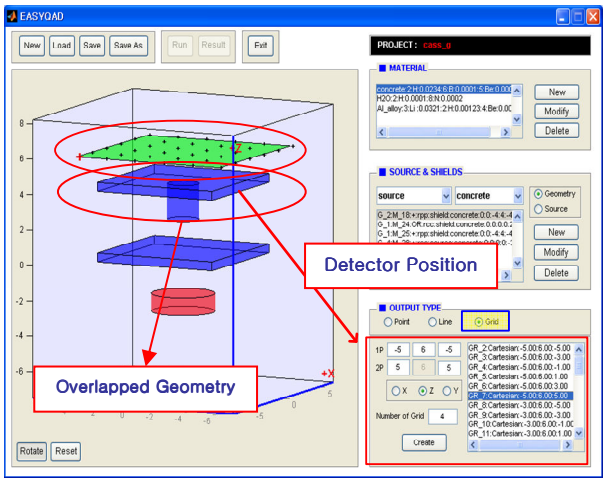

Figure 3. Overlapped geometry and detector selection

The common material library was built including about 180 widely used materials as shown in Figure 4. It is also possible for the users to add their own materials to this library.

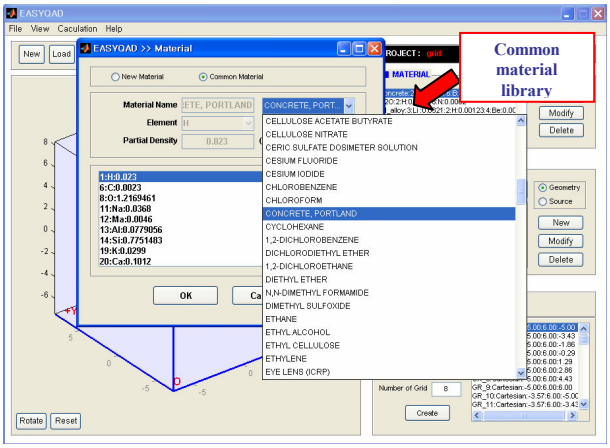

Figure 4. Common material library

To analyze the original output file produced by QAD-CGGP-A code, the OUPUT module was upgraded to visualize the results with bar, contour, and surface shapes. The input and output files of EASYQAD can be checked by users. Hence, it can prevent users from making input mistakes by debugging automatically the user input.

The comparison between EASYQAD developed in this work and its α-version was done in Table 2.

Table 2. Comparison of EASYQAD β-version and α-version (where O and X respectively represent available and unavailable)

Items	Contents	α-version	β-version
Geometry	Single Geometry	O	O
	Overlapped Geometry	X	O
Energy	Mono Energy	O	O
	Multi-group Energy	X	O
Source	Gamma-ray Calculation	O	O
	Neutron Calculation	X	O
	Energy Spectrum	X	O
	Source Translation & Rotation	X	O
Detector	Point Detector	O	O
	Line, Grid Detectors	X	O
Material	Basic Material Input	O	O
	Common Material Library	X	O

4. Conclusion

For a convenient gamma and neutron shielding calculations, EASYQAD was developed into a user-oriented visualization code system. It is powerful for non-experts to analyze the shielding problems without special training. Therefore, EASYQAD is expected to contribute effectively to the development of radiation shielding analysis by providing users in the medical and industrial fields with an efficient radiation shielding code. After the test of this version, it will be submitted to OECD/NEA.

5. Acknowledgment

This work was supported by the SRC/ERC program (R11-2000-067-01001-0).

REFERENCES

[1] "QAD-CGGP-A: Point Kernel Code System for Neutron and Gamma-Ray Shielding Calculations Using the GP Buildup Factor," RSICC-CCC-645, (1995).
[2] KOPEC, "Visual Shield version 1.0: Computer Code for Point Kernel Gamma Ray Shielding Analysis in Graphical Interfaces," (2001).
[3] Jae Cheon Kim, Chi Young Han, Soon Young Kim, Jong Kyung Kim, and Un Chul Lee, "Development of Graphical EASYQAD Code for Radiation Shielding Calculation," The Second Asian and Oceanic Congress for Radiation Protection (AOCRP-2), Beijing, China, Oct 9-13, (2006).