Condensed Neutron Energy Group Structure for Core Analysis of Material Test Reactor

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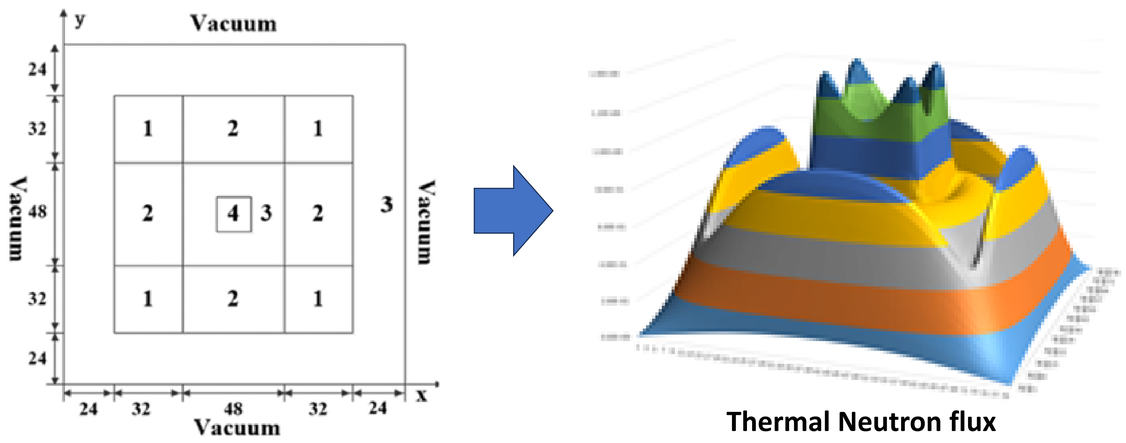
1. Introduction

The Korea Atomic Energy Research Institute(KAERI) has developed a reactor core analysis code 'PTSAC' based on the discrete ordinate method. To facilitate the core analysis of the KJRR (Ki-Jang Research Reactor) by using the code, its performance validation is currently undergoing through various benchmark calculations.

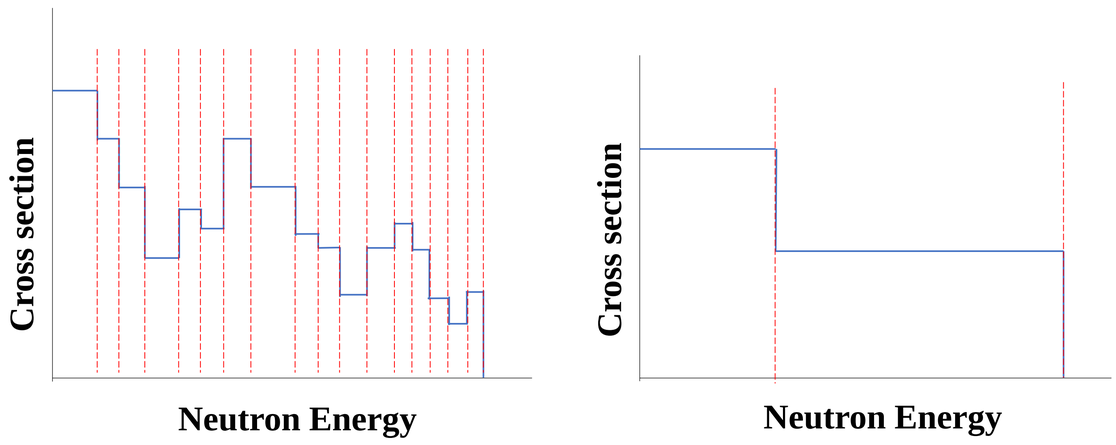
Reactor type	Pool
Reactor power	~20 MW
Fuel type	MTR type Plate
Fuel Material	U-7Mo 6.0gU
Fuel Enrichment	19.75wt%
Reflector	Beryllium
Coolant	Light Water

Basic Parameters of Ki-Jang Research Reactor



An Example of PTSAC's Benchmark Calculation

To ensure computational efficiency, it is necessary to condense the detailed nuclear data into a few representative group structures. The accuracy of the calculations depends on the chosen group structure.



Fine-group cross sections

- **long calculation time**
- **more computational resources required**
- **high accuracy**

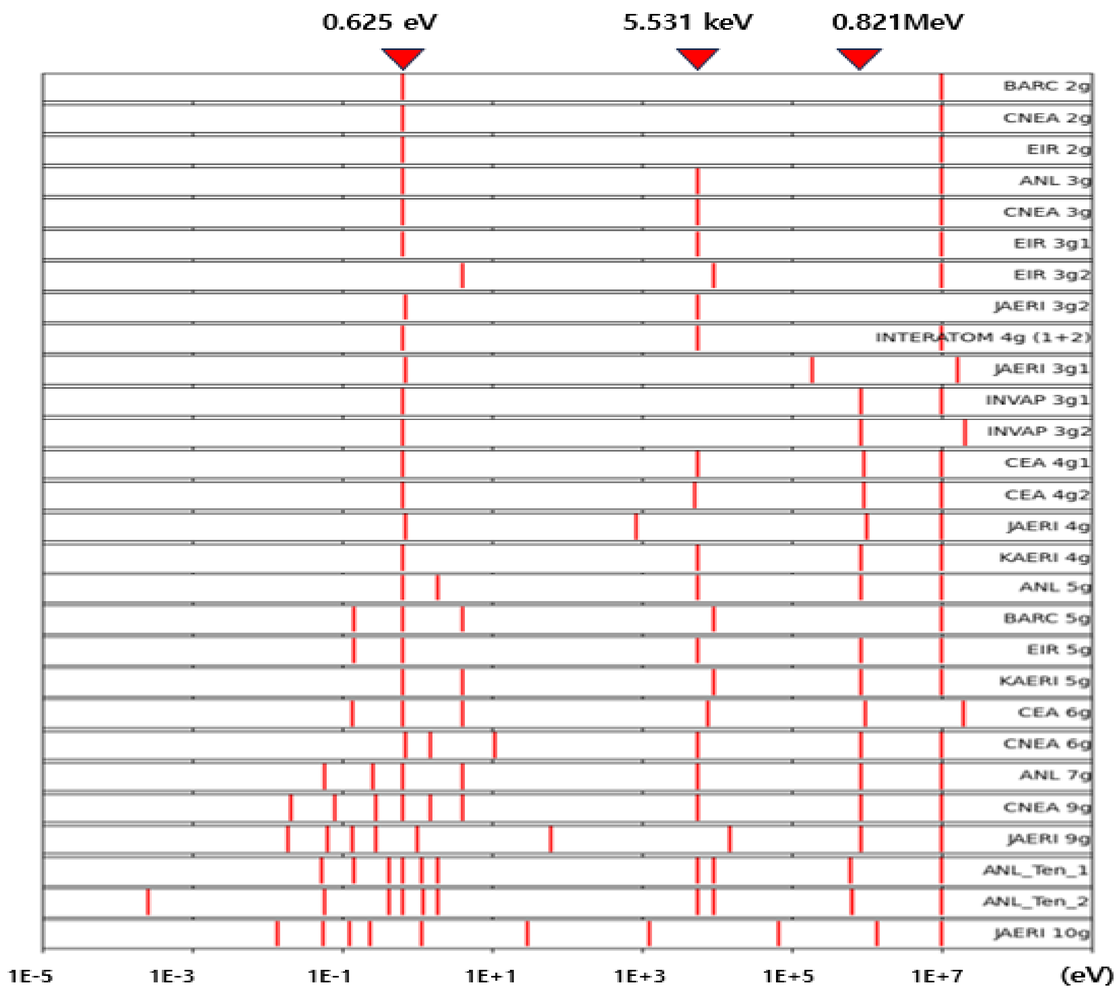
Few-group cross sections

- **short calculation time**
- **less computational resources required**
- **low accuracy**

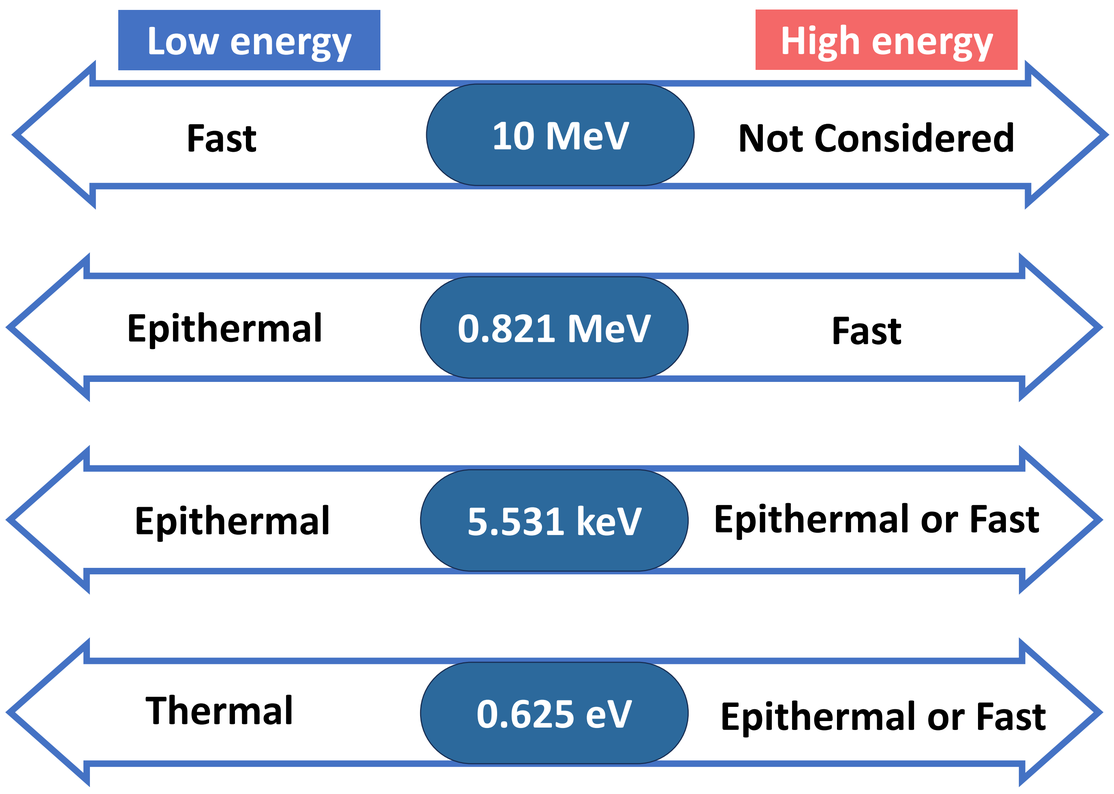
2. Method

The data were collected and analyzed from international collaborative research programs targeting research reactors such as the RERTR project. The cases of core analysis that were investigated mainly focused on IAEA's 10 MWt MTR benchmark. Additionally, core analysis cases targeting research reactors from various countries such as OPAL, Saphir, KURR, FNR, and others were included in the scope of the investigation.

3. Results and Discussions



The following four energies were mainly selected as group boundaries.



It was confirmed that the above four energies have traditionally been used as group boundaries of the few group structure in the core analysis.

4. Conclusions

In this study, a group structure for the core analysis of the KJRR is recommended. By analyzing energy group boundaries utilized in the various research reactors, an optimal selection of energy groups is proposed to reflect the appropriate neutron behavior within the reactor core. A four-group structure, consisted by energy boundaries of 0.625 eV, 5.531 keV, 0.821 MeV, and 10 MeV, will be deemed suitable for core analysis of the material test reactor. It is expected that the proposed group structure enhances the precision of calculation and contributes to the design and operation of the KJRR. However, further research and validation efforts are recommended to ensure the applicability and effectiveness of the proposed group structure.