**THESIS INFORMATION**

Thesis title: Development of neutronics analysis models and in-core fuel management optimization of the DNRR research reactor (HEU)

Speciality: Nuclear and atomic physics

Code: 62440501

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Academic year: 2016

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2. Associate Professor Tran Hoai Nam

At: VNUHCM - University of Science

1. **SUMMARY**:

Development and verification of neutronics analysis models for criticality and burnup calculations of the DNRR research reactor using the SRAC code system have been conducted. The impact of various nuclear data libraries such as ENDF/B-VII.0, JENDL3.3, and JENDL-4.0 on criticality and control rod worth analysis has been evaluated in comparison with MCNP5 calculations and measurement data. A discrete differential evolution (DE) algorithm has been developed and applied to fuel loading optimization of the DNRR research reactor using VVR-M2 HEU fuel.

**2. NOVELTY OF THESIS**:

- Development and verification of neutronics analysis models for criticality and burnup calculations of the DNRR research reactor with HEU fuel using the SRAC code system have been conducted successfully.

- The impact of various nuclear data libraries such as ENDF/B-VII.0, JENDL3.3, and JENDL-4.0 on the criticality and control rod worth calculation have been quantitatively investigated and compared with the MCNP5 calculations as well as the measurement data.

- A discrete DE algorithm has been successfully developed and applied to the problem of in-core fuel management optimization of the DNRR research reactor. Numerical calculations were performed based on the DNRR core loaded with 100 HEU fuel bundles with burnup levels ranging from 0% to 12,4% (percent loss of 235U).

- The optimal loading pattern obtained from the DE search is advantageous over the reference core by extending the operation time of about 1590-1670 h. The results also indicated the advantage of the DE over the genetic algorithm (GA) on the same problem.

1. **APPLICATIONS/ APPLICABILITY/ PERSPECTIVE**

- The analysis models of the DNRR research reactor with HEU fuel could be continuously extended to the currently operated core loaded with LEU fuel, improving the accuracy of the neutronics models for the DNRR research reactor.

- The analysis results will contribute to the knowledge about the VVR-M2 fuel type of the global community of nuclear research reactors.

- The discrete DE algorithm shows a good performance in the problem of in-core fuel management of the DNRR reactor. Further investigation of the DE method with more advanced variants on the problem of in-core fuel management is being conducted.

- Application of the DE algorithm to in-core fuel management of the current DNRR core with LEU fuel is being investigated.

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| **SUPERVISOR** | **PhD STUDENT** |

**A/Prof. Do Quang Binh A/Prof. Tran Hoai Nam Phan Thi Thuy Giang**

**CERTIFICATION**

**UNIVERSITY OF SCIENCE**

**PRESIDENT**