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BY

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THESIS

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Abstract

Abstract.

Acknowledgments

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Chapter 1

Introduction

1.1 Prismatic Gas-Cooled Reactors

This section will talk about different aspects of prismatic HTGRs:

- history
- features
- co-generation possibilities (highlight hydrogen production)

1.2 Motivation

This section will express the motivation behind this work.

1.3 Objectives

This section will summarize the objectives of this work.

Chapter 2

Literature Review

2.1 PMR neutronics

This section will talk about deterministic diffusion solvers and related past studies.

2.2 PMR thermal-hydraulics

This section will talk about thermal-hydraulic calculations in prismatic HTGRs and related past studies.

2.3 PMR multi-physics

This section will talk about previous efforts on multi-physic couplings for prismatic HTGRs.

Chapter 3

Methodology

3.1 MOOSE

This section will briefly talk about MOOSE features.

3.2 Moltres

This section will talk about Moltres features.

3.3 Serpent

This section will talk about Serpent features.

3.4 MHTGR-350 Summary

This section will describe the MHTGR350 main characteristics.

Chapter 4

Neutronics

4.1 Preliminary studies

This section will discuss the current capabilities in Moltres and discuss its applicability to PMRs.

4.2 OECD/NEA Benchmark

This section solves the Exercise 1 of Phase I of the OECD/NEA MHTGR-350 benchmark with the current Moltres capabilities.

4.3 Serpent-Moltres validation

This section compares the results from Moltres and Serpent. Serpent generates the homogenized group constants and also solves the heterogeneous system, which provides the reference solutions for the validation of the calculation scheme.

Chapter 5

Thermal-hydraulics

5.1 Preliminary studies

This section carries out some preliminar studies using Moltres and MOOSE heat conduction module.

5.2 Unit cell problem

This section will solve the unit cell problem in the hot spot of an HTGR.

5.3 Fuel assembly

This section will calculate the heat profile of a fuel assembly of a HTGR.

5.4 Full core

This section will extend the methodology to a fullcore problem and it will inted to solve Exercise 2 of Phase I of the OECD/NEA MHTGR-350 Benchmark.

Chapter 6

Hydrogen Production

6.1 Introduction

This section introduces the global warming and duck curve problem. This introduction also provides the motivation for such study.

6.2 iCAP

Brief description of the iCAP and how its goals aligns with the objectives of this work.

6.3 Objectives

This section summarizes the objectives of this study. Description on how the iCAP's goals align with the objectives of this work.

6.4 Hydrogen production methods

This section summarizes the most important features of the following hydrogen production methods: Electrolysis (LTE and HTE) and Sulfur-Iodine Thermo-chemical Cycle.

6.5 Microreactors and SMRs

This section gives a brief description of Microreactors and SMRs.

6.6 Methodology

This section discusses the methodology for:

- calculating the hydrogen required for transportation
- distributing the reactor power into electricity and hydrogen generation
- predicting the duck curve
- calculating the electricity to generate with the hydrogen

6.7 Results

This section holds the results of the different analyses.

6.8 Conclusions

This section holds the conclusions from this chapter.

Chapter 7

Conclusions

7.1 Contribution

This section will summarize the contributions of this thesis.

7.2 Future Work

This section will introduce some possible future work as a continuation of this thesis.

Appendix

Appendix.

References