A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

with a

Major in Nuclear Engineering

in the

College of Graduate Studies

University of Idaho

by

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Abstract

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ACKNOWLEDGEMENTS

This work and my coursework was completed under a Graduate Fellowship funded by Nuclear Regulatory Commission (NRC).

DEDICATION

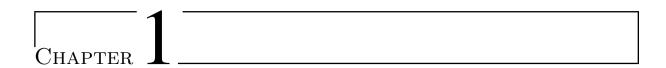
To my mother, Tammy, who planted and nurtured my love of science. To my father, Paul, who taught me how to design and build, and showed me that I am an engineer. To my cats, Babe and Bunyan, who stayed up with me all those late nights studying and writing. Thank you for your endless support.

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Introduction

1.1 Background

The Molten Salt Nuclear Battery (MSNB) is a self-contained design [?, ?]...

MICRO

Its like a reactor but smol.

MOLTEN SALT REACTORS

Light Water Reactor (LWR)

1.2 Scope

Until now, little to no work has been done on the control system...



PROCESS CONTROL ENGINEERING

2.1 Feedback

2.2 Feedforward

The term 'Feedforward' can be used to refer to any element in the control block diagram that exists outside of the feedback loop.

DISTURBANCE FEEDFORWARD

Not that useful since disturbance transport delay is on the order of minutes and disturbance dynamics are on the order of milliseconds

PRE-FILTER

This could be electronic (less ideal) or physically realized by decoupling

2.3 Time Variance

Fissile depletion - time function parameters or look-up table to gain-schedule and turn the time variant system into a shift invariant system.

In addition to the relatively slow time variance of fissile fuel depletion during steady-state critical operation, there are specific times in a MSNB's expected operational life-cycle that exhibit a higher degree of time variance: 1. Start-up; 2. Shut-down; and 3. Re-start.

START-UP

Black-start may need to deal with thawing salt - main concern is fission product neutron poison build-up (discuss the burnable poison stuff)

Shut-down

Planned shut-down

Emergency Shutdown/SCRAM(must be passive) Decay heat and keeping the salt liquid for restart

RE-START

 ^{135}Xe stripper

Chapter 3

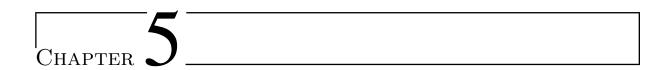
REACTOR CHARACTERIZATION

3.1 Reactor	DESIGN	SELECTION
3.2 Neutronics		Modeling
3.3 Process		SIMULATION

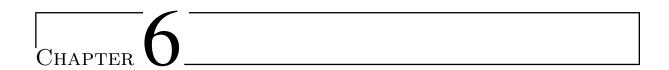
Chapter 4

Controller Design

4.1 REACTOR TRANSFER FUNCTION
4.2 TUNING METHODOLOGY

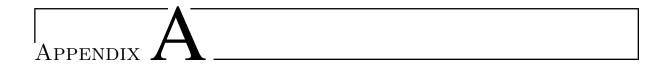


Results and Analysis



Conclusions

- 6.1 Limitations
- 6.2 Future Work
- 6.3 Summary Remarks



Test

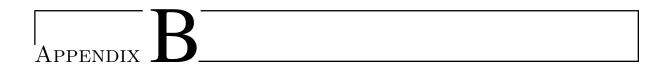
Code 1: Hello!

```
print("Hello World") #comment
try:
    a=2/x
except ZeroDivisionError:
print('undefined')
```

Inline codes like import numpy

Code 2: F strings

```
1  x = 4
2  print(f"The numeral four: {x}")
3  #comment
```



What

Straight Cash Homie