Dynamic System Modeling and Controller Design for a Molten Salt Microreactor

[a,*]Sam J. Root, [a]R. A. Borrelli, [b]Dakota Roberson, [a]Michael G. McKellar

University of Idaho - Idaho Falls Center for Higher Education
[a]Department of Nuclear Engineering & Industrial Management
[b]Department of Electrical & Computer Engineering

[*]root2892@vandals.uidaho.edu

2024.04.24

Number of pages - 15
Number of tables - 0
Number of figures - 1

Abstract

Acronyms

MSNB Molten Salt Nuclear Battery.

MSR Molten Salt Reactor.

NRC Nuclear Regulatory Comission.

PID Proportional-Integral-Derivative.

1 Introduction

[1]

1.1 Motivation

1.2 Goals

We ask the following questions -

(1) 1

(2) 2

(3) 3

To address these, we have the following goals for this paper -

(1) a

(2) b

(3) c

2 Background

3 Theory

4 Methodology

5 Results

5.1 Objective

6 Discussion

7 Future work

8 Summary remarks

Major results and implications include -

- 1
- 2
- 3

Acknowledgements

This work was completed under a Graduate Fellowship funded by Nuclear Regulatory Comission (NRC).

This research made use of the resources of the High Performance Computing Center at Idaho National Laboratory, which is supported by the Office of Nuclear Energy of the U.S. Department of Energy and the Nuclear Science User Facilities under Contract No. DE-AC07-05ID14517.

References

[1] Root, Sam J., 2023. Dynamic System Modeling & PID Controller Design for Molten Salt Microreactor. Master's thesis, University of Idaho.

Tables

Figures

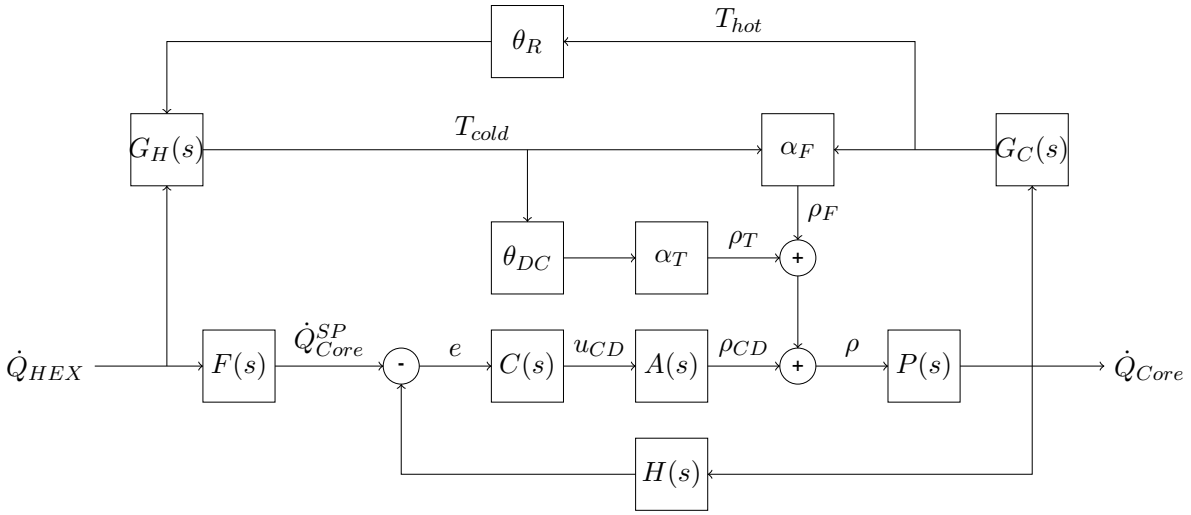

Figure 1. Control loop of a natural circulation MSNB. It is a normal feedback loop with a pre-filter, with the addition of the passive feedback mechanisms. The core ($\dot{Q}_{Core}$) and heat exchanger ($\dot{Q}_{HEX}$) powers go through the respective temperature dynamics (G_C and G_H) and time delays for the riser (θ_R) and downcomer (θ_{DC}) before being converted to reactivity by the temperature(α_T) and flow (α_F) feedback mechanisms. The passive reactivity feedback is combined with the control drum reactivity (ρ_{CD}) and fed into the reactor dynamics ($P(s)$).