

Design of a PID Controller for a Molten Salt Microreactor

Master's Plan

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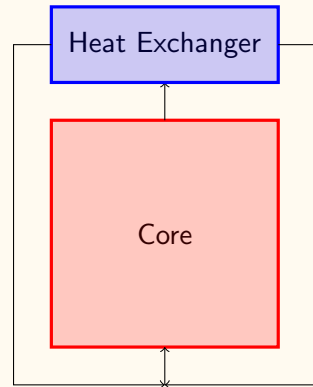
Outline

- 1 Scope
- 2 Applied Literature Review
- 3 Future Work
- 4 Final Remarks

Scope

Molten Salt Nuclear Battery (MSNB)

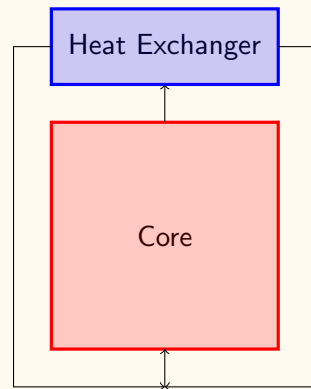
- Self-Contained liquid fueled molten salt micro-reactor



Simplified schematic drawing of an MSNB

Molten Salt Nuclear Battery (MSNB)

- Self-Contained liquid fueled molten salt micro-reactor
- 1 MW design using UF_4 dissolved in $FLiNaK$



Simplified schematic drawing of an MSNB

Molten Salt Nuclear Battery (MSNB)

- Self-Contained liquid fueled molten salt micro-reactor
- 1 MW design using UF_4 dissolved in $FLiNaK$
- Criticality is manipulated using axial control drums
 - Neutron absorber plate covering cylinders of neutron reflector
 - Drums are rotated to point more absorber towards the core to insert negative control reactivity

Background on MSNB

Neutronics

[1]

Thermal Hydraulics

[2]

Process Control

Me

[2] Carter, J. P., 2022. [Multi-physics investigation of a natural circulation molten salt micro-reactor that utilizes an experimental in-pile device to improve core physics and system thermal-hydraulic performance.](#)

Ph.D. thesis, University of Idaho

[1] Peterson, J., 8 2019. [An analysis of the nuclear characteristics of a molten salt microreactor.](#)

Master's thesis, University of Idaho

Figures from plotter (neutronics paper?), with a focus on control actuation

Applied Literature Review

Passive Feedback

Main Operational Control Problem - Transport Delay

Time-Variance and Non-Linearity

Future Work

Control Drum Characterization

MCNP

Process Simulation

Python

Controller Tuning

MATLAB-Simulink

Implementation and Testing

Python

Table: Timeframe for Execution of Project

Tasks	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Control Drums	X	X	X				
Process Simulation		X	X	X			
Controller Tuning				X	X		
Implementation					X	X	
Cross-Cutting						X	X
Defend							X

Final Remarks

Other Considerations

Acknowledgements

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1. Peterson, J., 8 2019. An analysis of the nuclear characteristics of a molten salt microreactor. Master's thesis, University of Idaho.
2. Carter, J. P., 2022. Multi-physics investigation of a natural circulation molten salt micro-reactor that utilizes an experimental in-pile device to improve core physics and system thermal-hydraulic performance. Ph.D. thesis, Univesity of Idaho.