Numerical Experiments for validating prediction algorithms Report

Draft 1

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Introduction

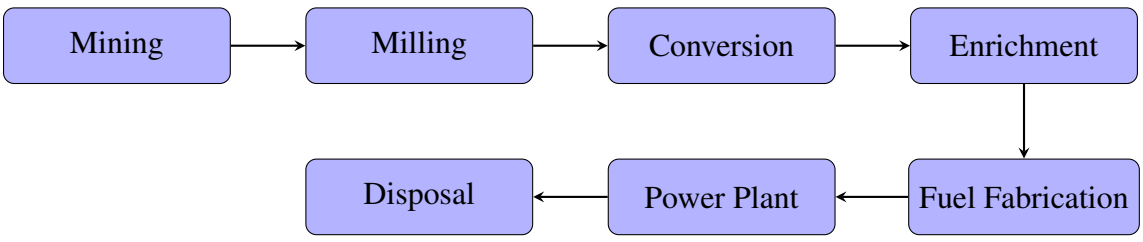
The main goal of the Demand-Driven Cycamore Archetype project is to develop in situ demand driven development schedule calculation through non-optimizing, deterministic-optimizing and stochastic-optimizing prediction algorithms so Cyclus has the capability to deploy supporting fuel cycle facilities to enable a demand to be met.

These prediction models are being developed by University of South Carolina. In this report, we discuss how to design numerical experiments for testing the non-optimizing, deterministic and stochastic prediction methods.

The first section evaluates the required tests for each method assuming a once through fuel cycle. A once through nuclear fuel cycle refers to when spent fuel is not reprocessed.

1 Once through Nuclear Fuel Cycle

Figure 1: Flow Chart of Once through Nuclear Fuel Cycle



Non-optimizing prediction method

Conditions for test to satisfy:

- Do all the reactors run at full capacity (not lacking fuel)?
- Is the input required by the reactors within a specific uncertainty of the analytic solution?
- Is the output of the fuel fabrication facilities within a specific range (more than?) of the input required by the reactors (calculated by the analytic solution) for all of them to run for each time step?
  - Is a new fuel fabrication facility deployed when the input required by the reactors exceeds the output of current fuel fabrication facilities?
  - Is a fuel fabrication facility decommissioned when the input required by the reactors falls behind the output of current fuel fabrication facilities?
- Is the output of the enrichment facilities within a specific range of the input required by the fuel fabrication facilities (calculated by the analytic solution) for each time step?
  - Is a new enrichment facility deployed when the input required by the fuel fabrication facilities exceeds the output of current enrichment facilities?
  - Is a enrichment facility decommissioned when the input required by the fuel fabrication facilities falls behind the output of current enrichment facilities?
- Is the output of the conversion facilities within a specific range of the input required by the enrichment facilities (calculated by the analytic solution) for each time step?
  - Is a new conversion facility deployed when the input required by the enrichment facility exceeds the output of current conversion facilities?
  - Is a conversion facility decommissioned when the input required by the enrichment facilities falls behind the output of current conversion facilities?
- Is the output of the milling facilities within a specific range of the input required by the conversion facilities (calculated by the analytic solution) for each time step?
  - Is a new milling facility deployed when the input required by the conversion facility exceeds the output of current milling facilities?
  - Is a milling facility decommissioned when the input required by the conversion facilities falls behind the output of current milling facilities?
- Is the output of uranium mining within a specific range of the input required by the milling facilities (calculated by the analytic solution) for each time step?

- Does the amount of uranium mined increase when the input required by the milling facility exceeds the output of current uranium mines?
- Does the amount of uranium mined decrease when the input required by the milling facilities falls behind the output of current uranium mines?

Deterministic-Optimizing/Stochastic prediction method

Conditions for test to satisfy:

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2 Reprocessing Nuclear Fuel Cycle