General Project Requirements

- Obtain a baseline steady state for a selected PWR.
- Build in necessary controls so that a transient can be automatically run to a second operating point involving a change of at least 5% thermal power.
- The project report should be written so that someone with a nuclear engineering background, but no knowledge of this class can understand what you did.

Reactor System Requirements

1. A full reactor vessel with heat structures representing the vessel wall and the core barrel;

2. A core with appropriate power from rods, and reasonable irrecoverable pressure losses across the core support plates;

3. Component models for all primary loops in your chosen plant, including a pressurizer on one loop;

4. Steam generators with active level control or other means of obtaining appropriate feedwater flow as power changes; and

5. A control block simulation of turbine shaft power output.

System Documentation

- Give a complete description of the “as built” system geometry, including component lengths, volumes, and cross-sections.
- Include sketches with dimensions marked with specific attention to the appearance of the core region.
- Reference your source (or sources) of information, and document assumptions that you make due to inadequate system descriptions.
- Describe how you choose to divide this system into finite volumes for TRACE and include all calculations that provide values of DX, FA, VOL, and HD for the input deck.
- Describe, calculations for any area change loss coefficients that you use (e.g. lower and upper core support plates).
- Provide a table of key parameters, such as: power; primary and secondary pressures and mass flows; and core inlet and outlet temperatures and pressures. Note both your model's values and those for your chosen plant.

Component Documentation

- Give the type of pump used, and its characteristics (rated head, rated flow, rated speed, rated torque). You may select one of the default head curves from the TRACE pump component.

- Give a full description of your chosen turbine performance model, including at least one reference to a text or journal article. Your model may be as simple as a constant efficiency turbine, but be careful to use standard definitions of turbine efficiency.

- For the steam line temperature at your chosen operating point, and a fixed turbine exhaust pressure, the hydraulic portion of your model will provide the turbine mass flow rate through an appropriate loss coefficient at the steam line exit.

- One or more control blocks must provide an edit of the rated turbine power for any reasonable turbine inlet conditions. This can be implemented as a table of turbine power as a function of turbine inlet pressure, but the table must be fully documented and justified (show all calculations and equations) in your report

Calculations

- Run one steady state calculation for your chosen power system at its standard operating conditions.
- Provide the input deck for this run and printed output of the last major edit.
- If the code does not declare a steady state provide a plot of turbine inlet temperature and pressure vs. time to justify your choice of a steady state dump.
- The system must contain a means to obtain appropriate steam generator feedwater flow for your second power state.
    - One possibility is an active control of the water level in the steam generator secondary.
    - Another is an enthalpy balance calculation.
    - Provide full documentation of your control system.
- Run a transient changing the thermal power to your chosen off-design value. Provide time history plots of :
    1. Steam Generator Feedwater and exit steam mass flow rates;
    2. Steam Generator Downcomer water level; and
    3. Cold leg and Hot leg temperatures

Intermediate Deadlines

Friday November 16: A full description of the Steam Generator that you will use, including the "real" configuration and your finite volume implementation. Implement the model in a deck very similar to stgenSS3.inp with feedwater flow set by a control block. Demonstrate that given the rated hot leg temperature and flow, the steam generator produces something close to the rated cold leg temperature. Check these results for the finer tube nodalizations.

Friday November 30: A full description of the vessel and core that you will use, including the real configuration and your finite volume implementation. Implement the model in a deck very similar to reactorCore.inp with a run showing that a combination of your plant's mass flow, cold leg temperature, and core power, produce something close to the correct hot leg temperature. At this point you should have consistent behavior between your core and steam generator models.

Thursday December 6: Provide me with a steady state at the base power. Include plots demonstrating that it is a steady state, the input model (ASCII input file or SNAP project file), and a table comparing key model inputs (e.g. power, primary mass flow), and outputs (e.g. important primary and secondary temperatures and pressures, and secondary mass flow rate) between your original plant specifications and values obtained from the calculation.

Grading on Intermediate Deadlines

You will get one of three marks on these assignments:

1. Complete, you've met all requirements for this section of the project, and may include the writeup as-is in your project report;
2. Incomplete, you need improvements indicated by my comments in your final report to receive full credit for this section; and
3. Nothing Submitted, at best you can receive 50% of the total points assigned to this section of the report.

Failure to turn in something on the intermediate deadlines is a very bad idea.