Thermodynamic optimization of the regenerative power conversion system of a nuclear power plant

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In the present study, the computer code, TAPCS, for the thermodynamic analysis of a regenerative steam cycle was developed to optimally design and accurately analyze the behavior of the power conversion system of a nuclear power plant. The TAPCS reflects the inefficiencies or irreverssibilities of the turbine and pump to make the analysis more descriptive of an actual operation. The code permits a fast thermodynamic optimization of the cycle if one or more of the parameters or properties are varied.

The main parameters that can be varied to influence the cycle efficiency are the initial steam pressure and temperature, the extracting steam pressure, the condenser pressure, and the number and type of a feedwater pre-heater. A Lagrange multiplier method was used to optimize the thermodynamic efficiency of the power cycle. The results of parametric analysis showed that there is an optimum operating point in the relationship between pressure of the turbine inlet and the condenser outlet.