Modeling and control strategy of a water-wall component in the supercritical once-through boiler

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The once-through type boiler is one of the advanced boilers with many outstanding features that can produce steam at high pressure and temperatures than other boilers. However, the operation and control of a once-through boiler could be more complicated than those of a drum-type boiler. The boiler's mathematical modeling and control strategy should be prepared to solve the problematic issues if any. The present work establishes a dynamic model of the boiler and a control design for the simulation, and the work determines the boiler's control strategy. The boiler model is based on physical laws and the conservation principles of mass, energy, and momentum. The model also uses the properties of steam-water. The boiler model and the Proportional Integral Derivative (PID) controller are embedded in Matlab/Simulink that is used for feedback control to make the control strategy. The control performance of the once-through boiler is analyzed comprehensively. The simulation results demonstrate the boiler's dynamic behavior reaching the desired state upon various input changes.