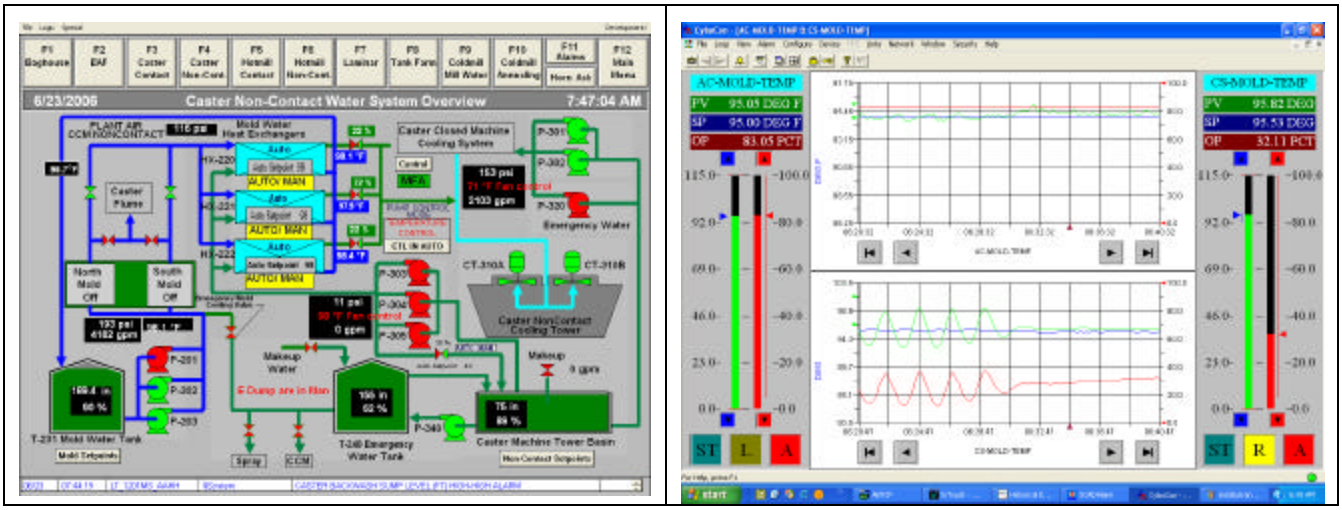
Model-Free Adaptive Control of Caster Mold Water Temperature

Use of MFA Control	*Benefits*
Tighter and more consistent control of supply mold water temperature under caster startup and tail-out transitions.	Improved steel product quality and plant efficiency.
No more controller tuning when season and process change.	Smoother and safer plant operations.
Solved two tough control problems in one day by using MFAs to control (i) Caster Supply Water Temp, and (ii) Rinse Water pH.	Return on investment (ROI) achieved within one month.



CyboSoft's MFA Control Solution for Steel Caster Mold Water Temperature

Process: Steel casters are critical operating units in a modern steel plant. The caster transforms the liquid steel into solid slabs, ready for the rolling mill to produce steel sheets. The liquid steel cools to form a molded shell, with the shape, thickness and width established by the mold. The mold consists of water-cooled copper plates attached to steel water boxes, forming a rectangle. Large amounts of caster cooling water is pumped at a high pressure through the mold to cool the steel. Since the water temperature affects the condition of the steel slabs, it is a critical quality related process variable and needs to be tightly controlled.

Application Story: Nucor Steel's Decatur, Alabama plant has a caster cooling water system that supplies non-contact cooling water to two 90mm continuous slab casters. As shown in the diagram, Pumps are used to supply mold water to 2 casters. Since the mold water leaving the casters is too hot, it is cooled by going through 3 heat-exchangers. The mold water temp is controlled by manipulating cooling water flow.

Control Challenge: During the steady state, a PID control system could maintain the mold water temp. But during a caster start-up or tail-out, there could be up to 8 degrees F deviation, which could cause product quality problems. Also, the system was sensitive to ambient temperature change, requiring PID re-tuning.

Solution: A SISO MFA controls the Caster Mold Water Temp by manipulating all 3 cooling water valves. An Anti-delay MFA is cascaded with the SISO MFA to control the actual Supply Mold Water Temp, which has large time delays. A feedforward MFA is used to produce quick control actions to compensate for the large disturbances.

MFA Control Results: As shown in the top trend above, the MFA system now can control the Supply Mold Water Temperature with +/- 1 degree F during normal operations as well as caster start-up and tail-out conditions. Product quality has been improved with a more consistent heat transfer rate.