Use of MFA Control

<table>
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<th>Use of MFA Control</th>
<th>Benefits</th>
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<tbody>
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<td>Tightly controls key process variables during various feed rate changes, operating conditions, and plant upsets.</td>
<td>Process stability, smoother operations, and higher yield are achieved.</td>
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<td>Decouples loop interactions and minimizes chain reactions among the columns.</td>
<td>Avoids potential vicious cycles, plant upsets, and accidents.</td>
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<td>Improves feed throughput and achieves higher product quality.</td>
<td>Return on investment within a few months.</td>
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**CyboSoft’s Distillation Column MFA Control and Optimization Solution**

**Process:** Distillation column chains are used to separate a liquid or vapor mixture of two or more substances into component fractions of desired purity. A reboiler brings the liquid at the bottom to the boiling point where the component with a lower boiling point will evaporate. Trays or plates inside the column shell enhance the separation. A condenser cools and condenses the vapor leaving the top. A reflux drum holds the condensed vapor and sends a portion back for recycling and improving the material and energy balance.

**Goals:** Distillation columns consume so much energy that it contributes to more than 50% of plant operating costs. It is desirable to tightly control bottom and tray temperatures to optimize separation, avoid flooding, minimize steam consumption, and maximize yield.

**Challenges:** Since it is a multi-phase and multivariable process with complex operating conditions, control of critical temperature, pressure, and level loops can be very difficult.

**Solution:** CyboSoft offers effective Model-Free Adaptive (MFA) control solutions for controlling critical process variables without the need to build column process models and retune controller parameters.

**Column Level Control:** Use a Robust MFA controller to smoothly control the level and minimize outlet flow variation to reduce potential vicious cycles in the column chains. User-selectable higher and lower bounds on level PV protect the level from running too high or too low during plant upsets.

**Column Temperatures:** Use a Multivariable MFA controller to manipulate the boiler flow and reflux flow setpoints to control the bottom and tray temperatures. Interactions between the bottom and tray temperatures are decoupled. Anti-delay MFA features may be enabled to handle the large time delays in these loops.

**Application Story:** Lanzhou Petrochemical Complex of PetroChina has deployed MFA controllers on 4 distillation columns in its MTBE production processes and achieved great results:

- Bottom and tray temperatures are controlled within +/- 3 deg C;
- Reduced reflux flow to achieve higher yield;
- Much smoother level control and plant operations;
- Improved production safety, separation efficiency, and productivity.