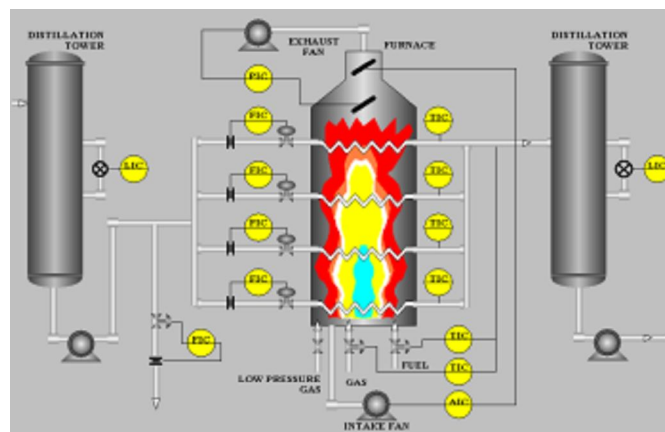


# Model-Free Adaptive Control of Oil Refinery Furnaces

<i>Use of MFA Control</i>	<i>Benefits</i>
Tightly controls furnace outlet temperature and minimizes deviations of zone temperatures.	Achieves smoother operations, higher yield, and energy savings.
Decouples loop interactions and minimizes chain reactions among the columns and furnaces.	Avoids potential vicious cycles, plant upsets, and accidents.
Improves feed throughput and minimizes over/under heating.	Return on investment within a few months.



## *CyboSoft's MFA Control Solution for Oil Refinery Furnaces*

**Process:** An oil refinery consists of a series of distillation towers and furnaces. Crude oil is piped through hot furnaces and resulting liquids and vapors are discharged into distillation towers to be separated into components or fractions by weight and boiling point. Gasoline, liquid petroleum gas, kerosene, diesel oil, and intermediate streams are produced.

**Goals:** Refinery furnaces consume so much energy that it contributes to a high percentage of operating costs. It is desirable to tightly control furnace temperatures and other process variables to optimize separation, minimize energy consumption, and maximize yield.

**Challenges:** A typical refinery furnace consists of multiple passes of oil pipes. It is naturally a multi-variable process with multi-zone temperature control problems. It is

difficult to tightly control the oil temperatures of each pass and outlet due to interactions between the passes and changing operating conditions. The distillation tower level and furnace combustion are also critical but difficult to control.

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

**Tower Level Control:** Use a Robust MFA to smoothly control the distillation tower level and minimize outlet flow variation to reduce potential vicious cycles in the distillation tower-furnace chain. User-selectable bounds on level PV protect the level from running too high or too low.

**Furnace Temperatures:** By using a MIMO MFA controller to manipulate the oil flow of each pass,

interactions between the temperatures are decoupled so effective temperature control can be achieved. An MFA controller is able to tightly control the Outlet Temp. Anti-delay MFA features may be enabled to handle the large time delays.

**Combustion Control:** Use a MIMO MFA to control the intake and exhaust fans. MFA can decouple the interactions of these 2 fans so that the fuel-air ratio can be effectively adjusted to achieve better combustion efficiency.

**Application Story:** SINOPEC has deployed an MFA control system for its vacuum furnace and distillation tower and achieved the following success:

- Outlet oil temp is controlled within +/- 1 deg C specification;
- Temp deviations between 4 passes are minimized;
- Better combustion and level control;
- Improved production safety, separation efficiency, and productivity.