# CH6605 Process Instrumentation, Dynamics and Control Advanced Control Schemes

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### Cascade Control - Temperature of Tank Contents



### Feedback Control - Dryer



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### Cascade Control - Dryer



https://control.com/textbook/basic-process-control-strategies/cascade-control/

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**Block Diagram** 



### Cascade Control Block Diagram - General



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Tertiary Loop



With Four Loops

 $C_{SP} \rightarrow$ TCI  $TC_2$  $\mathbf{FC}$ I/PCM

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#### Cascade-FourLoops

- The first controller (called the primary, or master) essentially "gives orders" to the second controller (called the secondary or slave) via a remote setpoint signal.
- The purpose of cascade control is to achieve greater stability of the primary process variable by regulating a secondary process variable in accordance with the needs of the first. An essential requirement of cascaded control is that the secondary process variable be faster-responding (i.e. shorter lag and dead times) than the primary process variable.
- A common implementation of cascade control is where a flow controller receives a setpoint from some other process controller (pressure, temperature, level, analytical, etc.), fluid flow being one of the fastest-responding process types in existence.

# Cascade Control Problem

Given the following block diagram,



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- (a) Express the transfer function (Y/X) as a ratio of polynomials in s.
- (b) Calculate the offset in C due to a unit step change in the reference signal (set-point) R.

### Feedback Control



900



### Feedback Control - Level



(a) Single loop control

### Cascade Control - Level



(b) Cascade control



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(a) Feed Forward Control



(b) Feed Forward + Feedback Control

Combined with Feedback Loop



(b) Feed Forward + Feedback Control

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Combined with Feedback Loop



Block Diagram Representation of Feedforward Plus Feedback Control Loop

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