

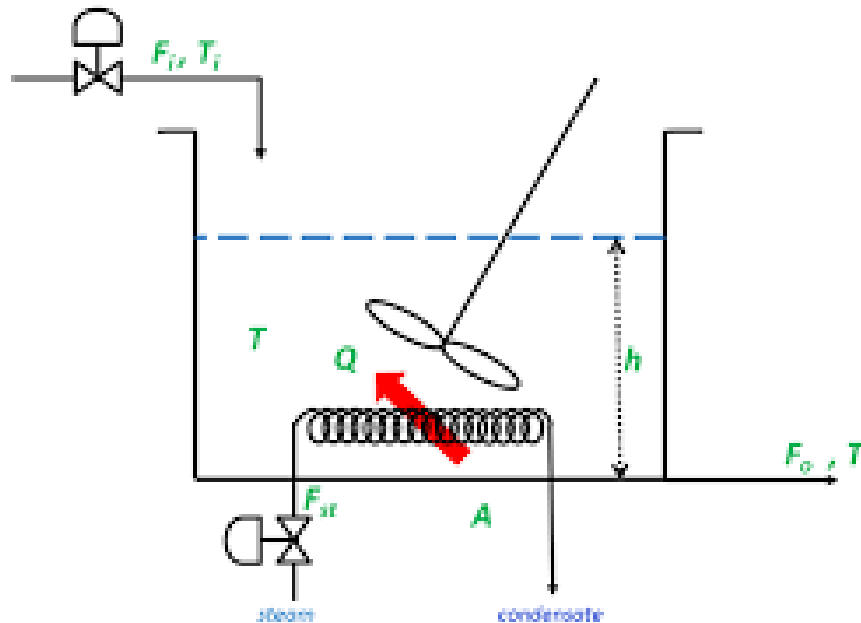
# Module 2

## feed-back and feed-forward control system

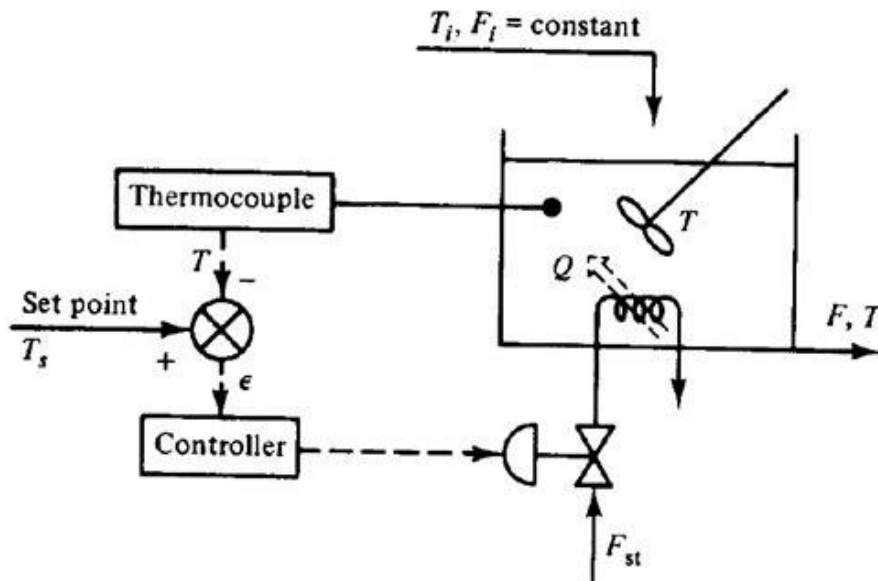
# Introduction

- Control system should satisfy the following criterion:
  1. Safety
  2. Product specification
  3. Environmental regulation
  4. Operational constraints
  5. economics

# Controlling the operation of a stirred tank heater



# Feed-back controller



- measure  $T$
- compare measured  $T$  with  $T_s$
- Compute error:

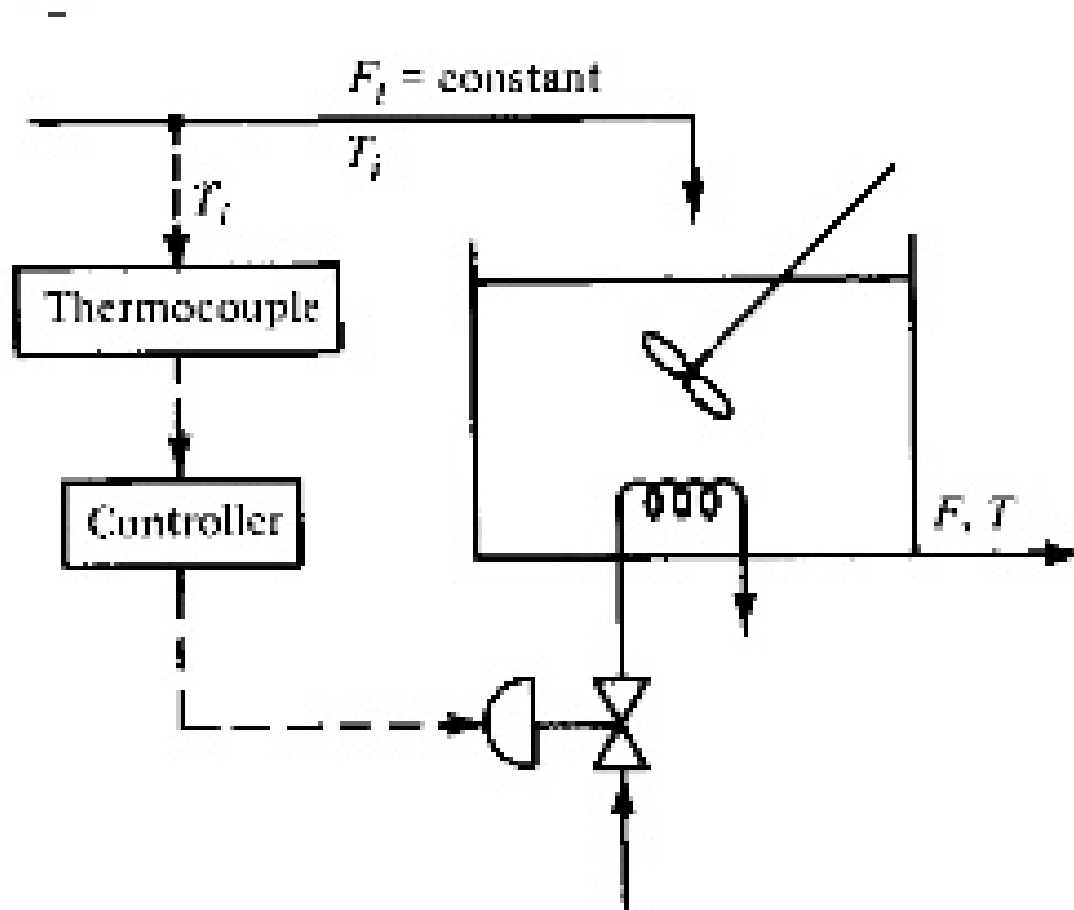
$$e = T_s - T$$

$e > 0$ ;  $T_s > T$  (increase  $F_{st}$ )

$e < 0$ ;  $T_s < T$  (reduce  $F_{st}$ )

Feedback Control in a Stirred Tank Heater  
(Stephanopoulos, 1984)

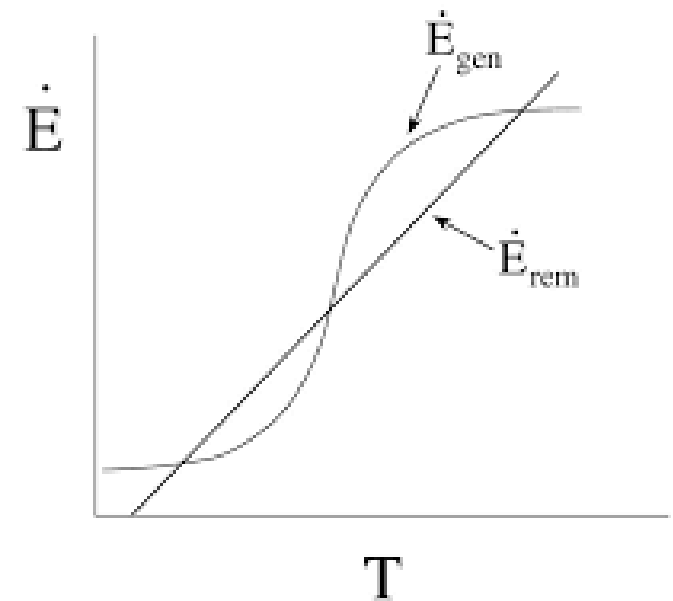
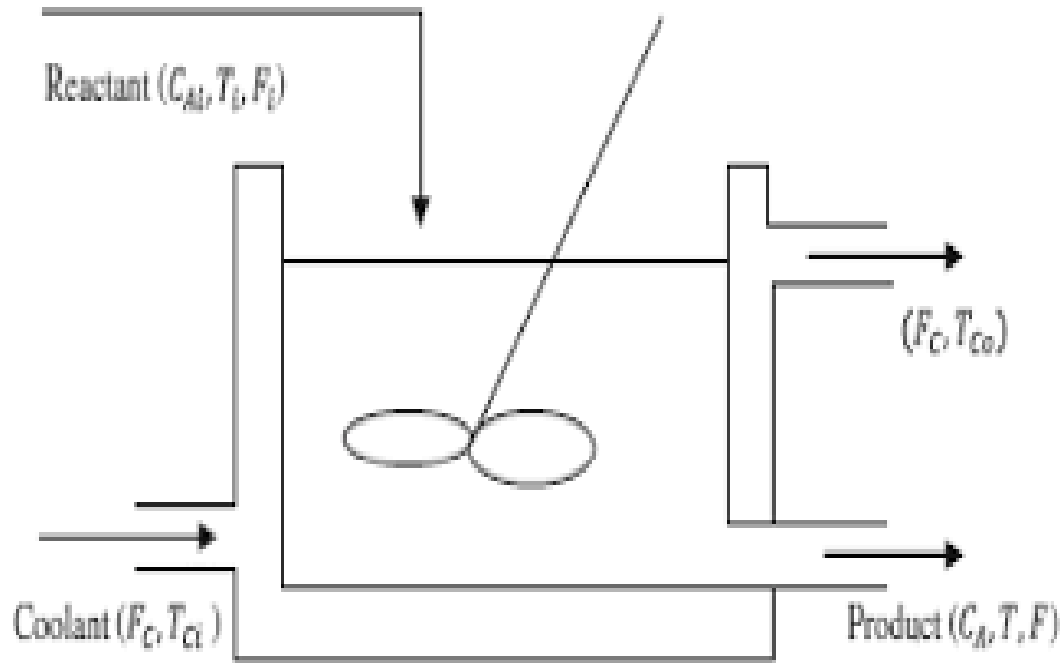
# Feed-forward controller



# Need of control system

1. Suppressing influence of external disturbance
2. Ensuring the stability of a chemical process
3. Optimizing the performance of a chemical process

# Control of an unstable reactor



# Components of feedback control system

- Different hardware components of control system
  1. The chemical process
  2. The measuring instrumentation
  3. Transducers
  4. Transmission lines
  5. Controller
  6. The final controlling element
  7. Recording element



# Variables in a chemical process

- Input variable
  - Manipulated variable
  - disturbance
- Output variable
  - Measured variable
  - Unmeasured variable

# P, PI & PID CONTROLLER

- Characteristics of P, PI & PID controller
- Offset, gain and integral time constant, derivative time constant
- Comparison shown in graph

