1. Include the control element that you need to install in operating the reactor and specify your justification
   1. What is the transfer function for the reactor?
   2. What is the order of the transfer function?
   3. Identify the control variable(s), manipulated variable(s), and possible disturbance variable(s) for the reactor.
   4. What type of control algorithm (P, PI, or PID controllers) would you use? Why?
2. What is the transfer function for the reactor?

Feed

Ti, ρ, w, c

Qh Qw

Product

T, ρ, w, c

Transfer function

Energy balance of the reactor:

Rate of entering system – rate of leaving system + rate of generation –rate of consumption= rate of accumulation

At dynamic state,

At steady state,

Subtract the dynamic state equation with steady state:

where:

, ,

Perform Laplace transform to the equation

At initial condition, =0,

,

1. What is the order of the transfer function?

First order transfer function.

1. Identify the control variable(s), manipulated variable(s), and possible disturbance variable(s) for the reactor.

Control variable:

* Temperature of the reactor,

The temperature of the reactor has to be maintained at 60°C as required for the reaction.

Manipulated variable:

* Heat supplied from the heat jacket,

Disturbance variables:

* Temperature of the feed,
* Heat loss to surrounding,

1. What type of control algorithm (P, PI, or PID controllers) would you use? Why?

PID controller. PID controller eliminates offset cause by the proportional algorithm, derivative algorithm reduces oscillatory effect which is caused by integral algorithm, and produces faster response as proportional algorithm act immediate when there is an error. PID controller is the best controller once it is tuned correctly.

Algorithm of PID:

Transfer function: