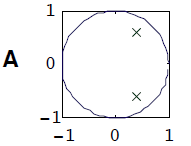
# Digital Control: Exercise 1

Xu Fei feixu12@student.hh.se

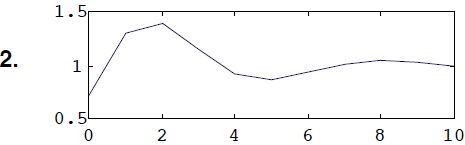
## , step response.

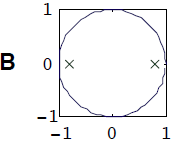
From this zero-pole graph, we can see there are two poles in this unit circle, so we can regard the poles as and, and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

We can see all the poles is inside the circle, so the system is stable.

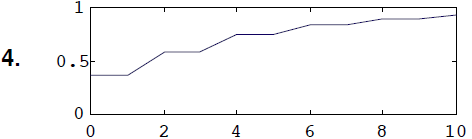
This unit step response is similar with number 2 picture.

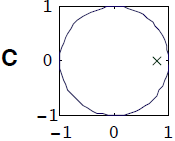
From this zero-pole graph, we can see there are two poles in this unit circle, so we can regard the poles as and, and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

We can see all the poles is inside the circle, so the system is stable.

This unit step response is similar with number 4 picture.



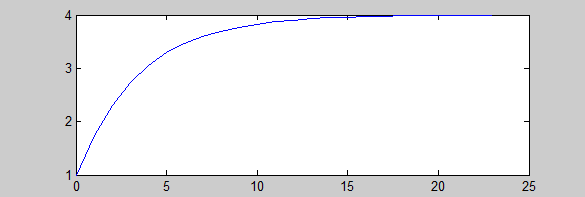
From this zero-pole graph, we can see there is one pole in this unit circle, so we can regard the pole as , and then we can regard the constant K as.

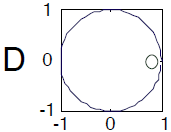
So, we can get the equation as:

So, we can transfer it into recursive form:

We can see the pole is inside the circle, so the system is stable.

So, the graph for this is not match. The correct graph for this unit step response should be like:

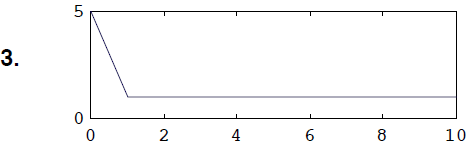


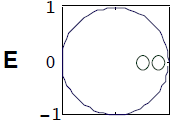
From this zero-pole graph, we can see there is one zero in this unit circle, so we can regard the zero as , and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

So,. The unit step response of this system is like number 3.



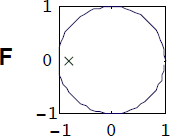
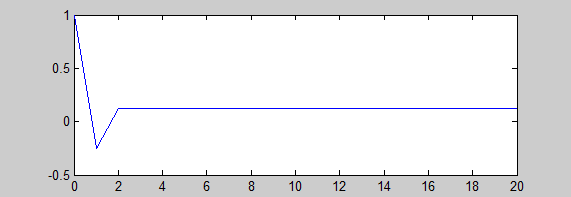
From this zero-pole graph, we can see there are two zeros in this unit circle, so we can regard the poles as , , then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

So,. The unit step response of this system is like number 3.

So, the graph for this is not match. The correct graph for this unit step response should be like:

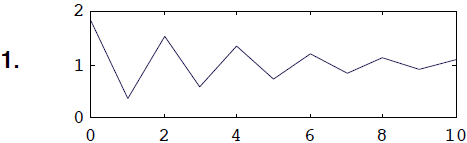


From this zero-pole graph, we can see there is one pole in this unit circle, so we can regard the pole as , and then we can regard the constant K as.

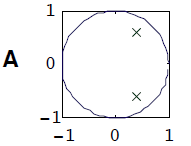
So, we can get the equation as:

So, we can transfer it into recursive form:

We can see the pole is inside the circle, so the system is stable.

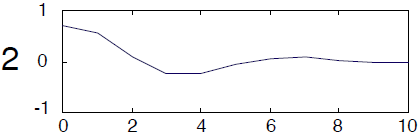
The unit step response of this system is like number 1.

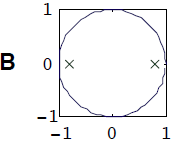
## , pulse response.

From this zero-pole graph, we can see there are two poles in this unit circle, so we can regard the poles as and, and then we can regard the constant K as.

So, we can get the equation as:

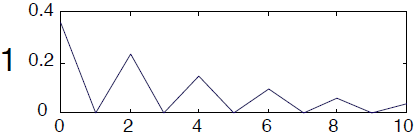
So, we can transfer it into recursive form:

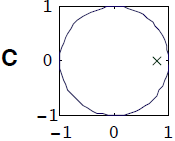
The impulse response of this system is like number 2.

From this zero-pole graph, we can see there are two poles in this unit circle, so we can regard the poles as and, and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

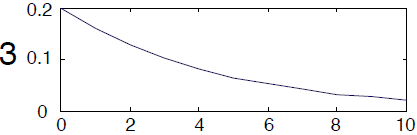
The impulse response of this system is like number 1.

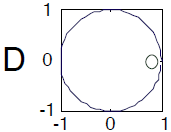


From this zero-pole graph, we can see there is one pole in this unit circle, so we can regard the pole as , and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

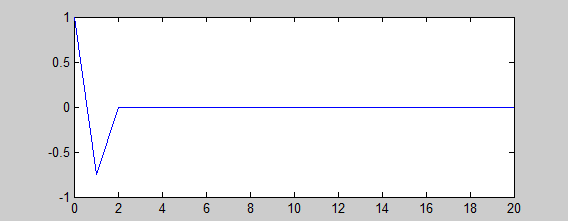
The impulse response of this system is like number 3.

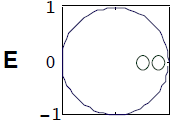
From this zero-pole graph, we can see there is one zero in this unit circle, so we can regard the zero as , and then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

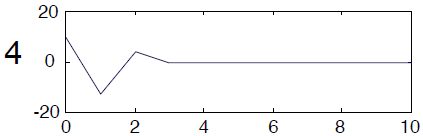
So, the graph for this is not match. The correct graph for this impulse response should be like:

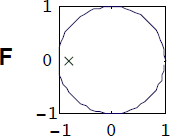


From this zero-pole graph, we can see there are two zeros in this unit circle, so we can regard the poles as , , then we can regard the constant K as.

So, we can get the equation as:

So, we can transfer it into recursive form:

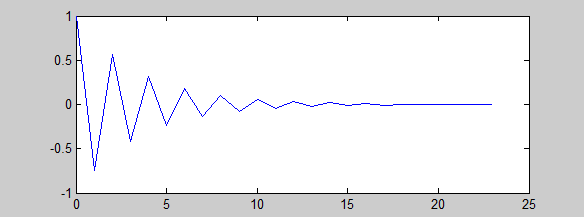
The impulse response of this system is like number 4.

From this zero-pole graph, we can see there is one pole in this unit circle, so we can regard the pole as , and then we can regard the constant K as.

So, we can get the equation as:

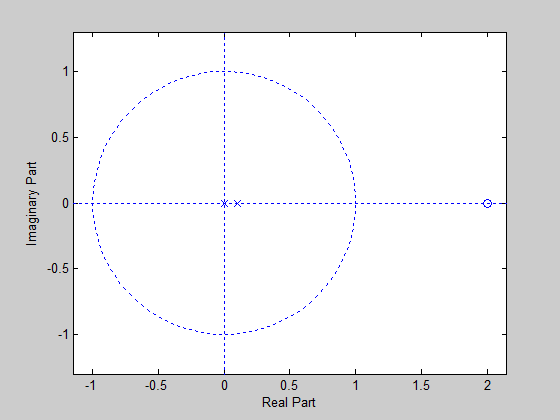
So, we can transfer it into recursive form:

So, the graph for this is not match. The correct graph for this impulse response should be like:



## What are the steady-state (stationary) gain of the following systems?

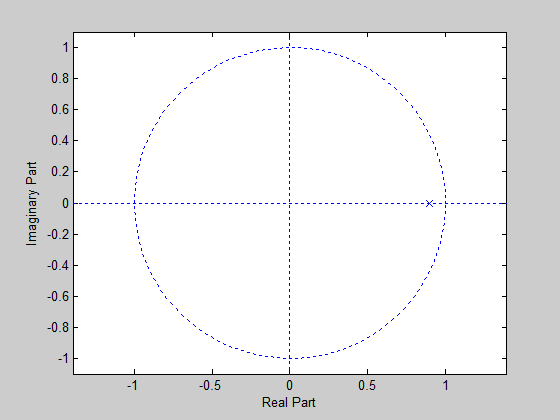
We can make the zero-pole graph like this:



We can see clearly from the graph, that there are two poles, and, and the only zero is, we can see all the poles are in the unit circle, so the system is stable,

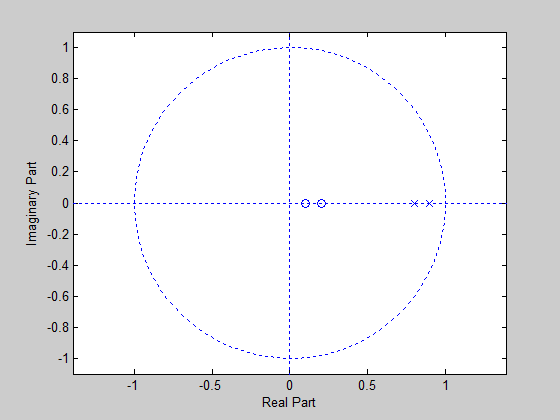
We can transfer to differential equation as:

We can make the zero-pole graph like this:



We can see clearly from the graph, that there is one poles,, we can see the pole is in the unit circle, so the system is stable,

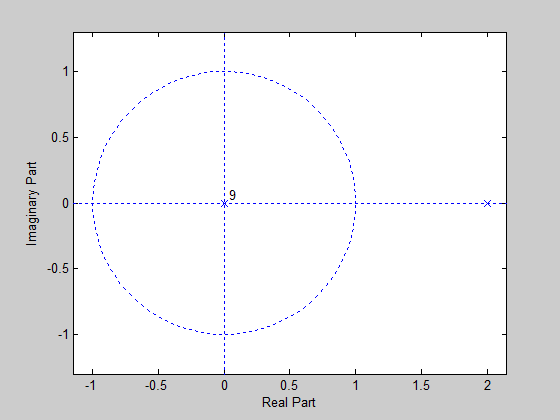
We can make the zero-pole graph like this:



We can see clearly from the graph, that there are two poles, and, and the only zero is and, we can see all the poles are in the unit circle, so the system is stable,=-360

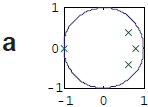
We can transfer to differential equation as:

We can make the zero-pole graph like this:



We can see clearly from the graph, that there is one poles,, we can see the pole is not in the unit circle, so the system is not stable, we can’t get any steady-state gain from this system.

## , step response.

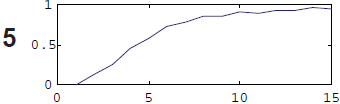
From the zero-pole graph, we can see all the four poles are in this unit circle, so the system is stable, and we can assume these four poles as, , and , and then we regard K as .

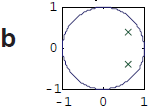
So, we can get the equation as:

Then, we can transfer it to differential equation:

We can see the pole is inside the circle, so the system is stable.

The step response of this system is like number 5.

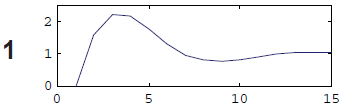


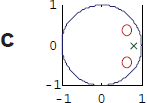
From the zero-pole graph, we can see all the two poles are in this unit circle, so the system is stable, and we can assume these two poles as, , and then we regard K as .

So, we can get the equation as:

Then, we can transfer it to differential equation:

We can see the pole is inside the circle, so the system is stable.

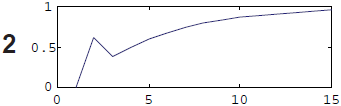
The step response of this system is like number 1.

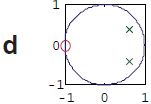
From the zero-pole graph, we can see the pole is in this unit circle, so the system is stable, and we can assume this pole as, two zeros as, , and then we regard K as .

So, we can get the equation as:

Then, we can transfer it to differential equation:

We can see the pole is inside the circle, so the system is stable.

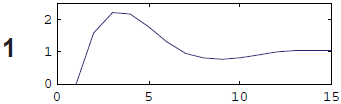
The step response of this system is like number 2.

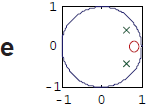
From the zero-pole graph, we can see all the poles are in this unit circle, so the system is stable, and we can assume these two poles as, , the zeros as, and then we regard K as .

So, we can get the equation as:

Then, we can transfer it to differential equation:

We can see the pole is inside the circle, so the system is stable.

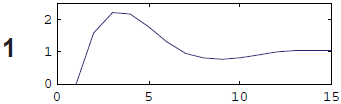
The step response of this system is like number 1.

From the zero-pole graph, we can see all the poles are in this unit circle, so the system is stable, and we can assume these two poles as, , the zeros as, and then we regard K as .

So, we can get the equation as:

Then, we can transfer it to differential equation:

We can see the pole is inside the circle, so the system is stable.

The step response of this system is like number 1.

## Group Problems.

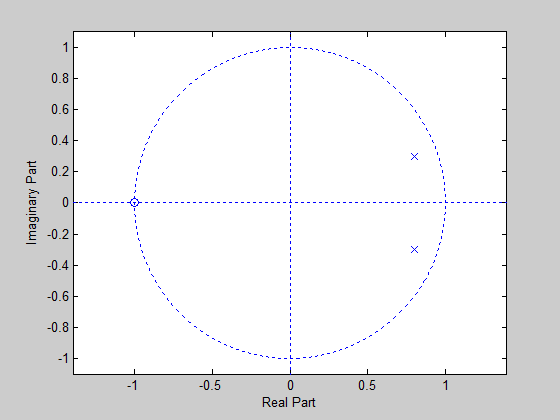
For fulfill the requirements, we can build the system function like this:

We choose the group 3 which,, so we can the equation like this:

We can see, so the system is stable, from the requirement, we know the steady-state gain is 2.

So, the system is:

We can draw the zero-pole graph as:



We can transfer the system to the differential equation:

Here, we use step response,

Here’s the step response:

