**EE 5111 CA3b Assignment for Control design**

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1. PID controller for system

(1) State space model:

Known that the transfer function , the state model can be written as:

The error state-space model is:

= +

(2)

With error model, define the following cost function:

Designed that the Q = diag(100,100,100) and R = 1, K = -lqr( A, B, Q, R). the solution is

K = 10.0000 21.0564 2.6968

Ki = 10, Kp = 21.0654, Kd = 2.6968

The diagram and step response can be shown below:

图示

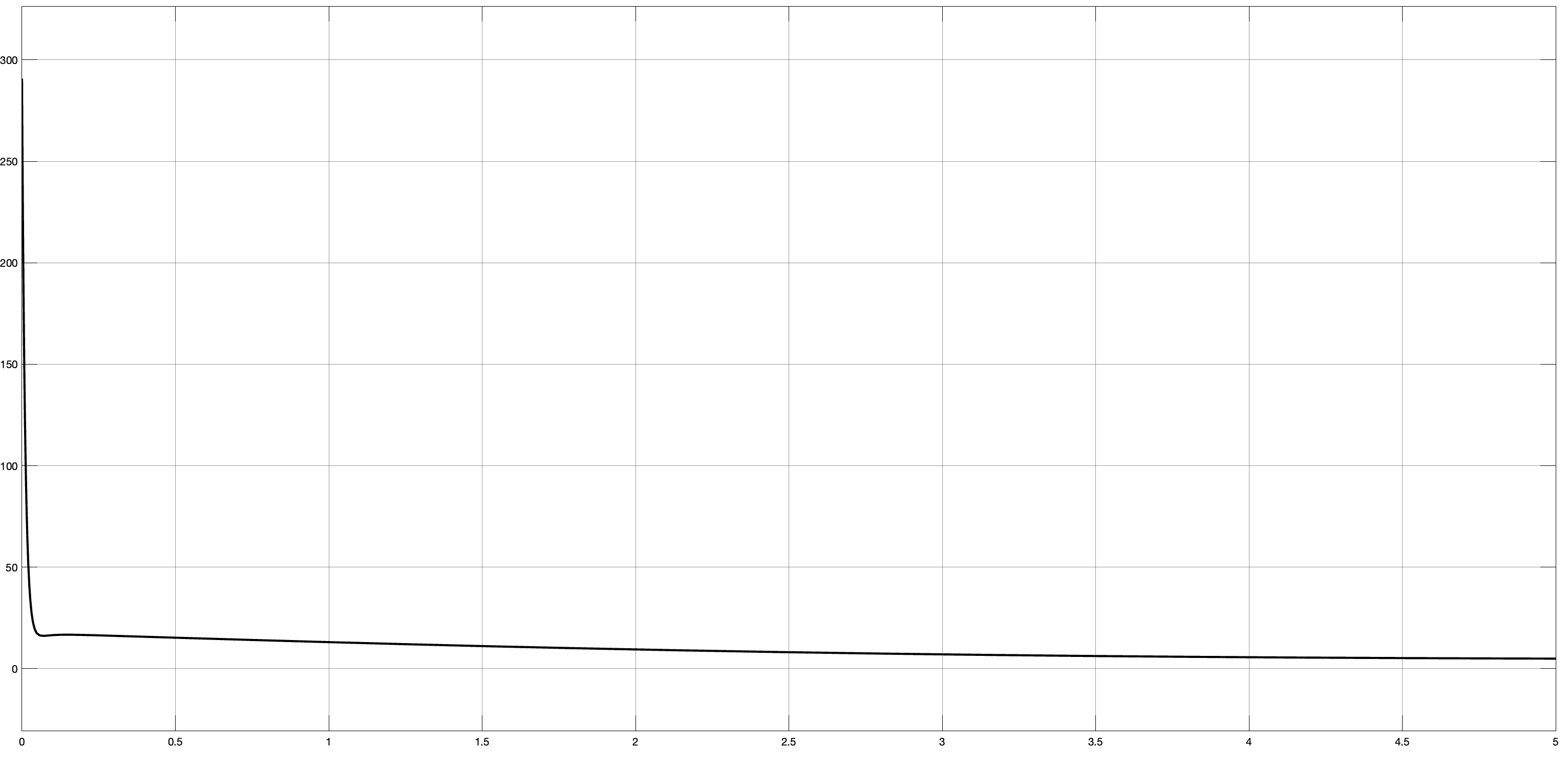
描述已自动生成

Step response:

图片包含 小, 公共, 瓷砖, 厨房

描述已自动生成

Control Signal:



(3) Effect of Q and R weight

Q = diag(1000,1000,1000) and R = 1:

Ki, Kp,Kd = 31.6228 55.4991 16.6653

Step response:

图片包含 图形用户界面

描述已自动生成

Control signal:

门上的瓷砖

中度可信度描述已自动生成

Q = diag(10,10,10) and R = 1:

Ki, Kp,Kd = 3.1623 9.0222 0.5547

Step response:

图形用户界面

中度可信度描述已自动生成

Control signal:

图形用户界面, 应用程序, 表格, Excel

描述已自动生成

Q = diag(100,100,100) and R = 0.01

Ki, Kp,Kd = 100.0000 170.9820 79.7233

Step response:

图形用户界面

中度可信度描述已自动生成

Control signal:

图表

中度可信度描述已自动生成

Q = diag(100,100,100) and R = 10

Ki, Kp,Kd = 3.1623 9.0222 0.5547

Step response:

图表, 折线图

描述已自动生成

Control signal:

瓷砖地上

低可信度描述已自动生成

Analysis:

If we increase the number in Q, the setting time of the system will be shorter, and the input signal will be larger. If we increase the number in R, the setting time of the system will be longer, and the input signal will be smaller. The larger Q also leads to larger K parameter whereas the larger R leads to smaller K parameter.

2. PLC and ladder diagram

