

Report

1a

Loading the given data.

```
load('Q1_Output_2x2_Step_Response_Data.mat')
```

Visualizations

```
subplot(2,2,1)
plot(U1.time,U1.signals.values)
hold on
plot(G11U1.time,G11U1.signals.values)
title('G11')
legend('U1','G11U1')

subplot(2,2,2)
plot(U2.time,U2.signals.values)
hold on
plot(G12U2.time,G12U2.signals.values)
title('G12')
legend('U2','G12U2')

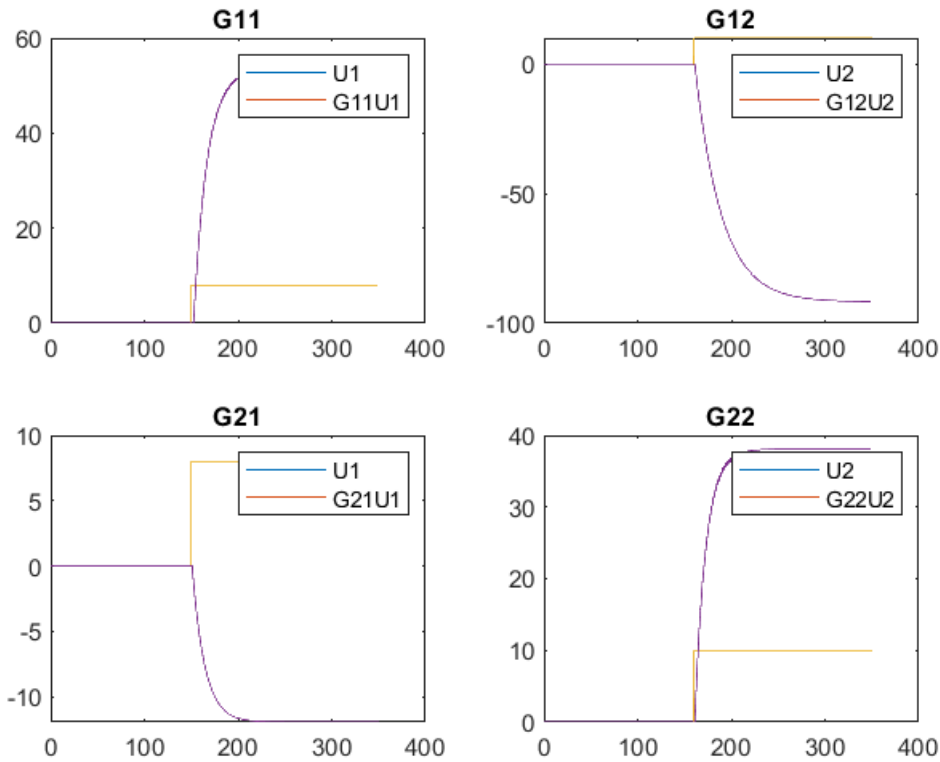
subplot(2,2,3)
plot(U1.time,U1.signals.values)
hold on
plot(G21U1.time,G21U1.signals.values)
title('G21')
legend('U1','G21U1')

subplot(2,2,4)
plot(U2.time,U2.signals.values)
hold on
plot(G22U2.time,G22U2.signals.values)
title('G22')
legend('U2','G22U2')
```

Estimating transfer functions G11, G12, G21 and G22 using tfest method.

G11

```
G11U1_iddata = iddata(G11U1.signals.values,U1.signals.values,0.1);
%From the step Response plot we can identify the delay to be 2.5s
G11 = tfest(G11U1_iddata,1,0,2.5);
```



G11

G11 =

From input "u1" to output "y1":

$$\exp(-2.5*s) * \frac{0.469}{s + 0.07025}$$



Continuous-time identified transfer function.

Parameterization:

Number of poles: 1 Number of zeros: 0

Number of free coefficients: 2

Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:

Estimated using TFEST on time domain data "G11U1_iddata".

Fit to estimation data: 99.81%

FPE: 0.002442, MSE: 0.002438

G12

```
G12U2_iddata = iddata(G12U2.signals.values,U2.signals.values,0.1);
%From the step Response plot we can identify the delay to be 1.1s
G12 = tfest(G12U2_iddata,1,0,1.1);
G12
```

G12 =

From input "u1" to output "y1":

$$-0.3245$$

$$\exp(-1.1s) * \frac{\quad}{s + 0.03536}$$

Continuous-time identified transfer function.

Parameterization:

Number of poles: 1 Number of zeros: 0
 Number of free coefficients: 2
 Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:

Estimated using TFEST on time domain data "G12U2_iddata".
 Fit to estimation data: 99.89%
 FPE: 0.001959, MSE: 0.001956

G21

```
G21U1_iddata = iddata(G21U1.signals.values,U1.signals.values,0.1);
%From the step Response plot we can identify the delay to be 1.1s
G21 = tfest(G21U1_iddata,1,0,1.1);
G21
```

G21 =

From input "u1" to output "y1":

$$\exp(-1.1s) * \frac{-0.1132}{s + 0.07582}$$

Continuous-time identified transfer function.

Parameterization:

Number of poles: 1 Number of zeros: 0
 Number of free coefficients: 2
 Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:

Estimated using TFEST on time domain data "G21U1_iddata".
 Fit to estimation data: 99.85%
 FPE: 7.535e-05, MSE: 7.522e-05

G22

```
G22U2_iddata = iddata(G22U2.signals.values,U2.signals.values,0.1);
%From the step Response plot we can identify the delay to be 1.1s
G22 = tfest(G22U2_iddata,1,0,1.1);
G22
```

G22 =

From input "u1" to output "y1":

$$\exp(-1.1s) * \frac{0.3288}{s + 0.08636}$$

Continuous-time identified transfer function.

Parameterization:

Number of poles: 1 Number of zeros: 0
 Number of free coefficients: 2
 Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "G22U2_iddata".
Fit to estimation data: 99.68%
FPE: 0.003464, MSE: 0.003458