**Lab No# 3**

**Objective:**

Generate a MATLAB Code to solve the system’s block diagram by implementing the Append and Connect Commands.

**Theory:**

In this lab we use another method to solve the system block diagram and determine the transfer function in s-domain by generating the MATLAB code. To perform this lab we need the following commands:

* **Append:**
* This command creates a new time series object by concatenating time series ts1, ts2, and so on, along the time dimension.
  + - * + ts = append(ts1,ts2, ... tsn)
* **Connect:**
* The connect command interconnects the block diagram elements by matching the input and output signals you specify in the Input name and Output name properties of sys1,...,sysN.
  + - * + sysc = connect(sys1,...,sysN,inputs,outputs)
* **Pretty:**
* This command is used to print symbolic output of X in a format that resembles typeset mathematics.
  + - * + pretty(X)
* **Tf(‘s’):**
* This command is basically used to create any transfer function (ratio of output over input) by the user defined values of numerator and denominator.
  + - * Sys=tf(num,den)
* **Simplify:**
* This command performs algebraic simplification of S using MuPAD simplification rules. If S is a symbolic matrix, this command simplifies each element of S.
  + - * simplify(S,Name,Value)

**Task 1:** Find the transfer function C/R in s-domain of the given closed loop system by using append and connect commands.

G(s) = H(s) =

**Coding:**

s=tf('s')

a1=2/(s+1)

a2=3/s

sys=append(a1,a2)

q=[1 -2;2 1]

systf=connect(sys,q,1,1)

**Result:**

systf =

2 s

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s^2 + s + 6

Continuous-time transfer function.

**Task 2:**Find the transfer function C/R in s-domain of the given open loop system by using append and connect commands.

G1(s) = G2(s) = G3(s) =

**Coding:**

s=tf('s')

b1=3/(s+2)

b2=1/(s+3)

b3=1/(s+1)

sys=append(b1,b2,b3)

q=[1 0;2 1;3 2]

systf=connect(sys,q,1,3)

**Result:**

systf =

3

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s^3 + 6 s^2 + 11 s + 6

Continuous-time transfer function.

**Task 3:**Find the transfer function C/R in s-domain of the given closed loop system by using append and connect commands.

G1(s) = G2(s) = G3(s) = H1(s) = 2

**Coding:**

s=tf('s')

a1=3/(s+2)

a2=1/(s+3)

a3=1/(s+1)

a4=2

sys=append(a1,a2,a3,a4)

q=[1 -4;2 1;3 2;4 3]

systf=connect(sys,q,1,3)

**Result:**

systf =

3

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s^3 + 6 s^2 + 11 s + 12

Continuous-time transfer function.

**Task 4:** Find the transfer function C/R in s-domain of the given closed loop system by using append and connect commands.

G1(s) = G2(s) = G3(s) = G4(s) = 3 H1(s) = 2 H2(s) =

**Coding:**

s=tf('s')

a1=3/(s+2)

a2=1/(s+3)

a3=1/(s+1)

a4=3

a5=2

a6=1/s

sys=append(a1,a2,a3,a4,a5,a6)

q=[1 -6 0;2 1 0;3 1 0;4 2 -3;5 4 0;6 5 0]

systf=connect(sys,q,1,4)

**Result:**

systf =

-18 s

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s^4 + 6 s^3 + 11 s^2 + 6 s - 36

Continuous-time transfer function.

**Lab Assignment**

**Task 1:**Find the transfer function C/R in s-domain of the given closed loop system with multiple inputs by using append and connect commands.

G1(s) = G2(s) = H1(s) = 2 H2(s) =

**Coding:**

s=tf('s')

a1=3/(s+2)

a2=1/(s+3)

a3=2

a4=1/s

sys=append(a1,a2,a3,a4)

q1=[1 -3 0;2 1 -4;3 2 0;4 2 0]

systf1=connect(sys,q1,1,2)

q2=[1 -3 0;2 -4 0;3 2 0;4 2 0]

systf2=connect(sys,q2,2,2)

q3=[1 -3 0;2 -4 0;3 2 0;4 2 0]

systf3=connect(sys,q3,2,2)

q4=[1 -3 0;2 1 -4;3 2 0;4 0 0]

systf4=connect(sys,q4,3,2)

sys=systf1\*systf2\*systf3\*systf4

**Results:**

systf1 =

3 s

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s^3 + 5 s^2 + 13 s + 2

Continuous-time transfer function.

systf2 =

s

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s^2 + 3 s + 1

Continuous-time transfer function

systf3 =

s

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s^2 + 3 s + 1

Continuous-time transfer function.

systf4 =

-6

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s^2 + 5 s + 12

Continuous-time transfer function.

sys =

-18 s^3

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s^9 + 16 s^8 + 121 s^7 + 543 s^6 + 1539 s^5 + 2727 s^4 + 2782 s^3 + 1387 s^2 + 310 s

Continuous-time transfer function.

**Task 2:**Find the transfer function C/R in s-domain of the given closed loop system by using append and connect commands.

G1(s) = G2(s) = G3(s) = G4(s) = 3 H1(s) = 2 H2(s) = H3(s) = 1

**Coding:**

s=tf('s')

a1=3/(s+2)

a2=1/(s+3)

a3=1/(s+1)

a4=3

a5=2

a6=1/s

a7=1

sys=append(a1,a2,a3,a4,a5,a6,a7)

q=[1 5 0;2 1 -7;3 2 6;4 3 0;5 2 0;6 4 0;7 3 0]

systf=connect(sys,q,1,4)

**Result:**

systf =

9 s

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s^4 + 6 s^3 + 3 s^2 - 13 s -15

Continuous-time transfer function.

**Conclusion:**

In this lab I learnt how to use the Append and the Connect command to solve any block diagram, also verified the answers by manually solving the block diagrams .I also learnt how to solve the multiple input single output (MISO) system on MATLAB.