Control System Laboratory Report

Name and ID no. of the Student:

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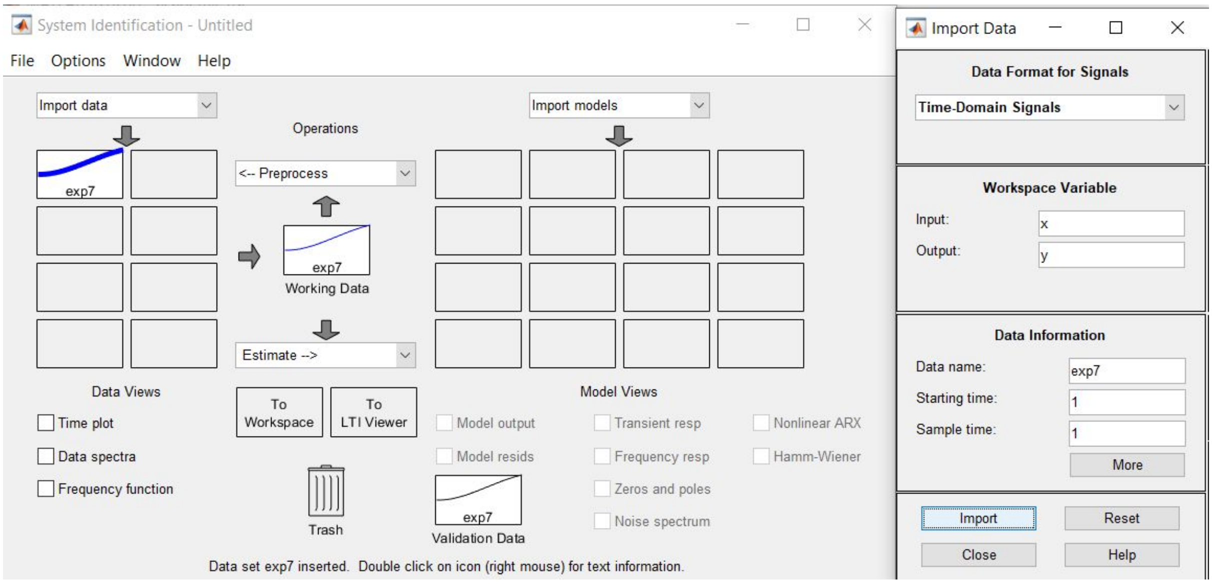
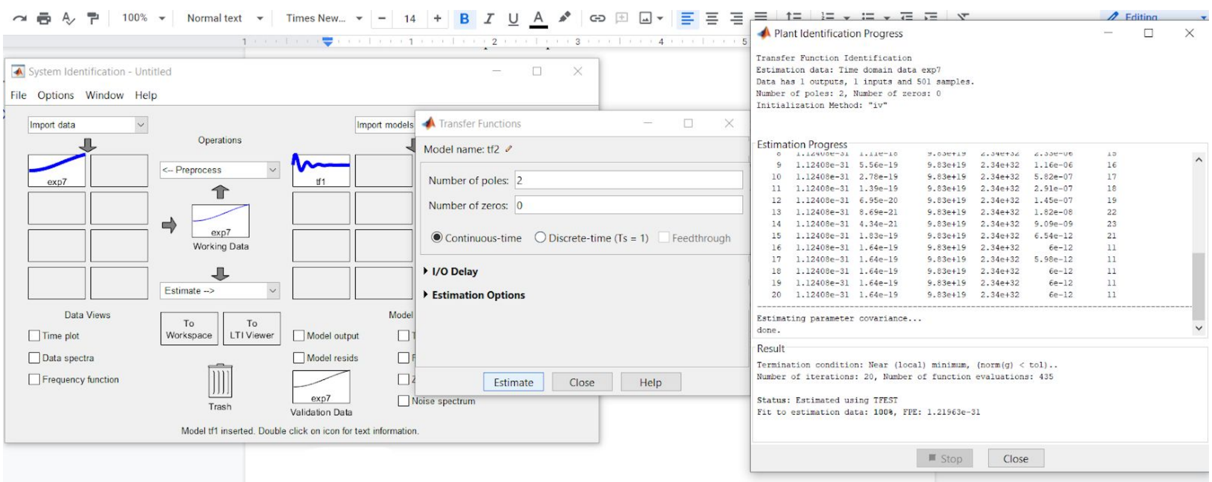
Title of the Experiment:

Measurement of servo speed and pendulum moment of inertia

Model/Simulation:





x and y data is taken from the .m file which was provided

This time-domain data is imported into the System Identification toolbox and estimated the Transfer Function of the system.

Results:

```
>> tf1

tf1 =

  From input "u1" to output "y1":
         0.0025
  ---------------------
  s^2 + 0.02 s + 0.0025

Name: tf1
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 2   Number of zeros: 0

>> damp(tf1)

         Pole              Damping       Frequency      Time Constant
                                       (rad/seconds)      (seconds)

 -1.00e-02 + 4.90e-02i     2.00e-01      5.00e-02         1.00e+02
 -1.00e-02 - 4.90e-02i     2.00e-01      5.00e-02         1.00e+02
```

Conclusive remarks:

The transfer function of the system is obtained using the estimation done by the system identification toolbox from the given time-domain data.

Now comparing the obtained results of the transfer function with the equation:

$H(s) = \Omega_J(s)/\Omega_{in}(s) = (K/J)/(s^2 + (B/J)*s + K/J)$

given B = 1.2 N-m-s/rad.

and K = 15 N-m/rad.

we get B/J = 0.02. => J = 60 $Kg.m^2$

and K/J = 0.0025. => J = 6000 $Kg.m^2$

The value of J can be calculated from both the terms but since B is more dominant than K in an actual real-world situation, the effect of damping friction is more dominating than that of the spring constant, So J is calculated to be 60 $Kg.m^2$.

Now comparing the Second-order transfer function obtained using the estimation done by System toolbox Identification, we find w_n i.e. natural frequency of the system, $w_n = 0.05$ rad/sec and also damping ratio(ζ) to be $\zeta = 0.2$ which is an underdamped system.