C S 487/519 Applied Machine Learning I
Project-Stage 2

Group members:

1. Amer Al-Radaideh (800641066) (in-class session)
2. Benjamin Peaslee (800527925) (online-class session)
3. Khandker Mushfiqul Islam (800701988) (online-class session)

Problem Formulation:

In Aerospace research in general, scientists needs to perform computer simulations before conducting any real experimental tests. However, it's difficult to obtain an exact dynamics model of the systems to represent the actual one.

In such research, researchers need to know the dynamics model between the PWM input commands to the drone's motors and the collective thrust force that is generated, see **Figure 1**. The dataset plotted and shown in Figure 2

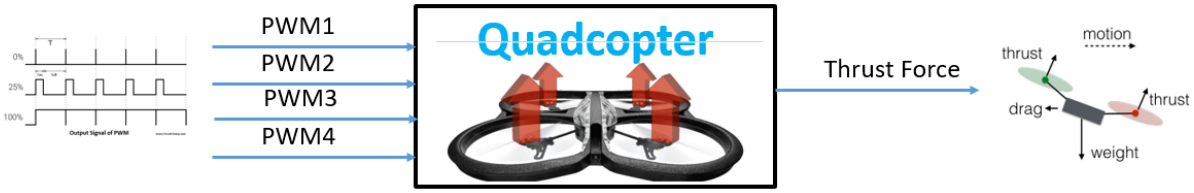

Figure 1Input-output diagram

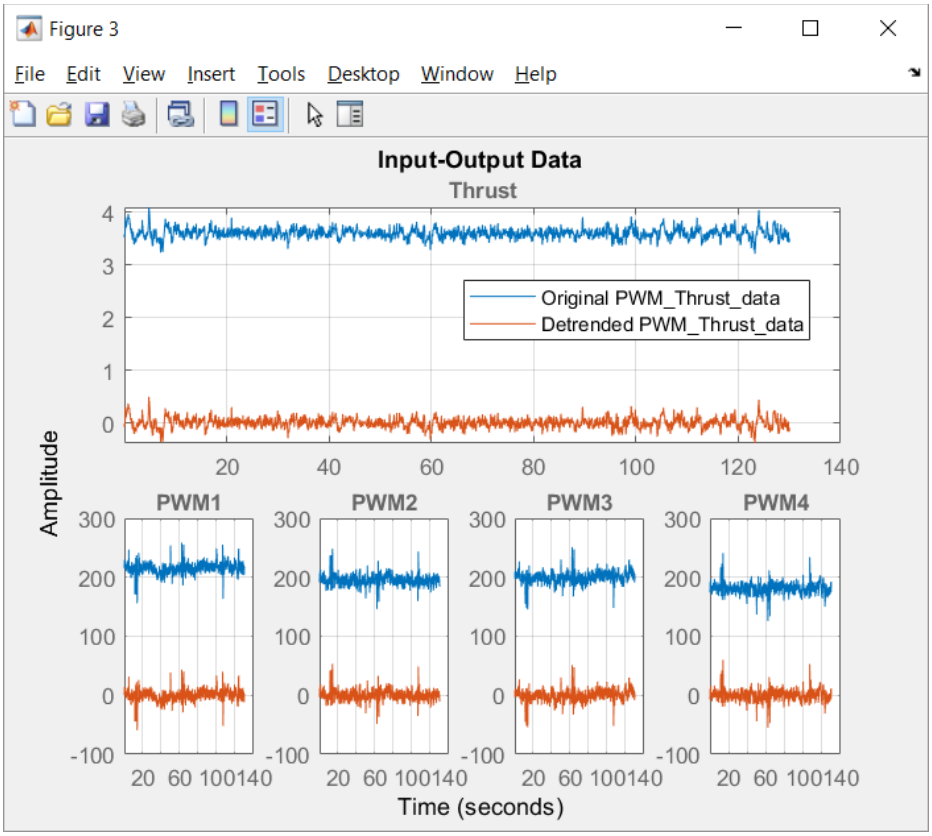

Figure 2 Input-Output Data plots

Motivations:

The motivation behind this project is to be able to get the most possible accurate model that represents the thrust force due to the input PWM commands.

Thrust force estimation for rotary-wing vertical take-off and landing (VTOL) UAVs is challenging due to the difficulty to mount the load cell sensors and get the readings while its flying in the air.

Unlike traditional aerodynamic modeling solutions, in this project, we are looking forward to utilize one of the machine learning-based method which does not require the details of the aerodynamic information to model the Thrust-PWM relation.

The proposed method includes two stages: an off-line training stage and an on-line thrust estimation stage. Only flight data is used for the on-line estimation stage. We use Parrot AR.Drone as the testing quadrotor.

Preliminary studies:

We have used the system Identification toolbox under Matlab environment to see how good are the results can be.

The transfer function models was selected as one of the possible models to try. As shown in Figure 3 and Figure 4, the transfer function gave a lousy results.

We are looking forward to try one of the Machine-Learning based techniques to find the best fit model.

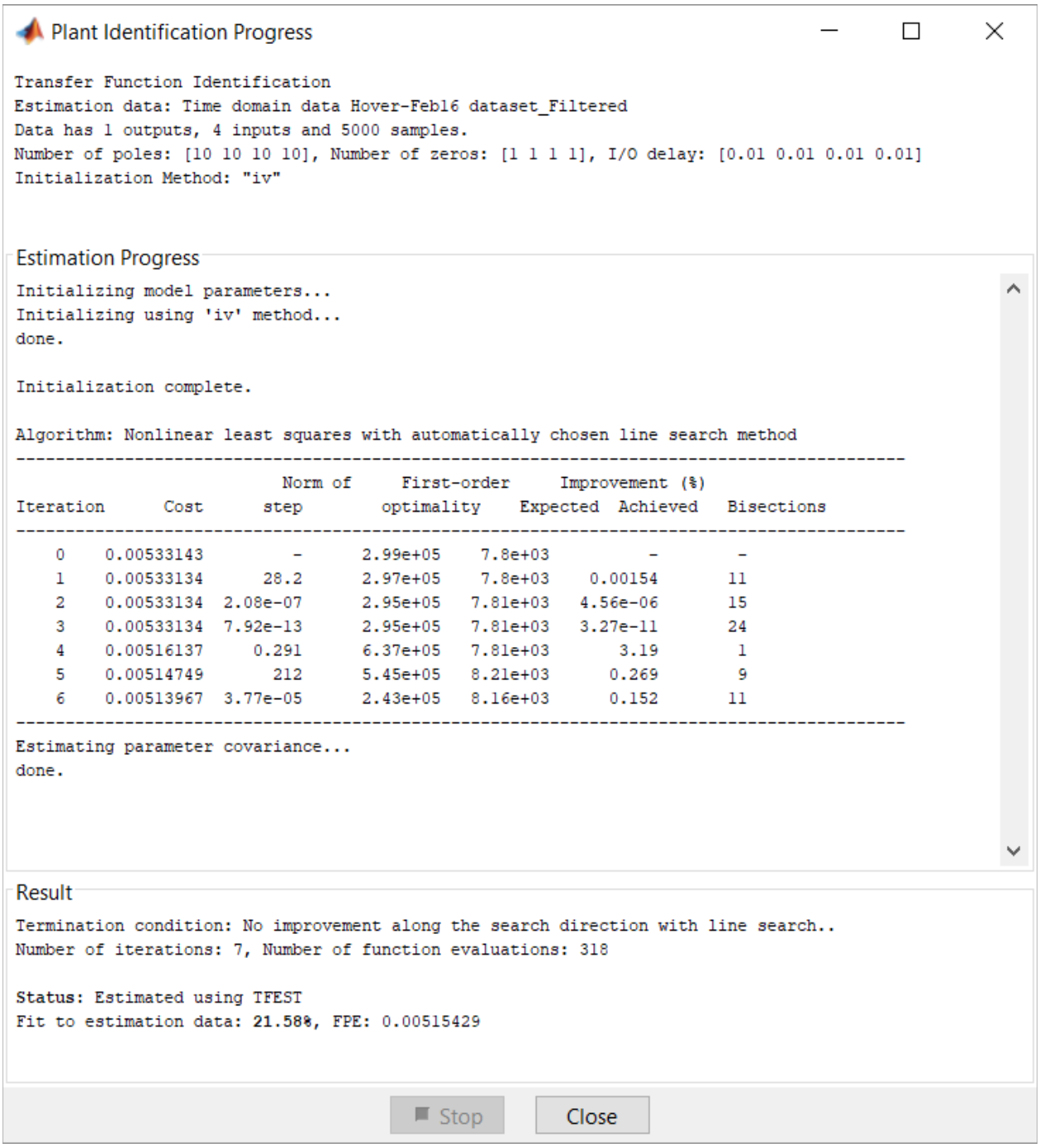

Figure 3 Transfer functions estimation

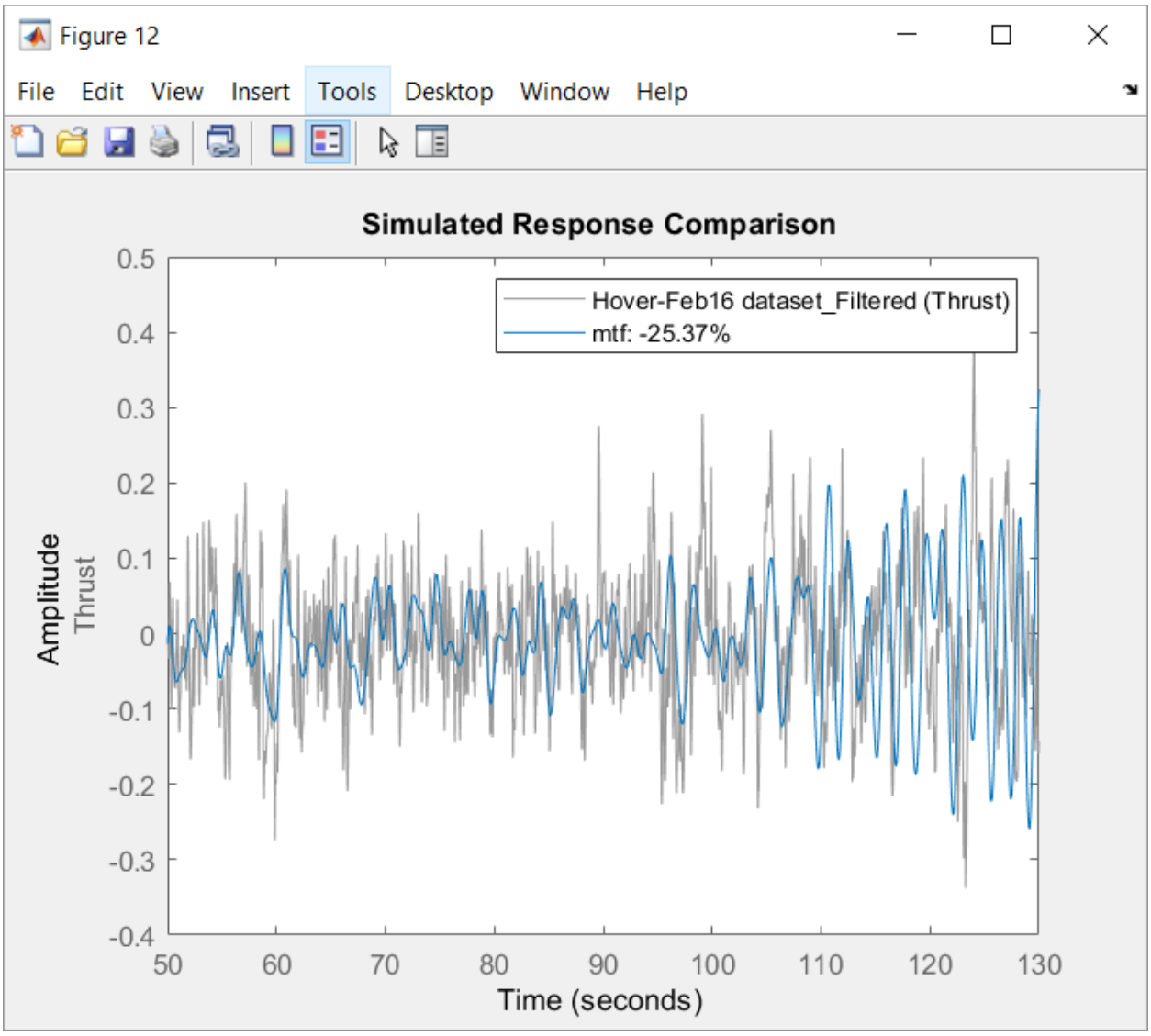

Figure 4 Simulated Response Comparison