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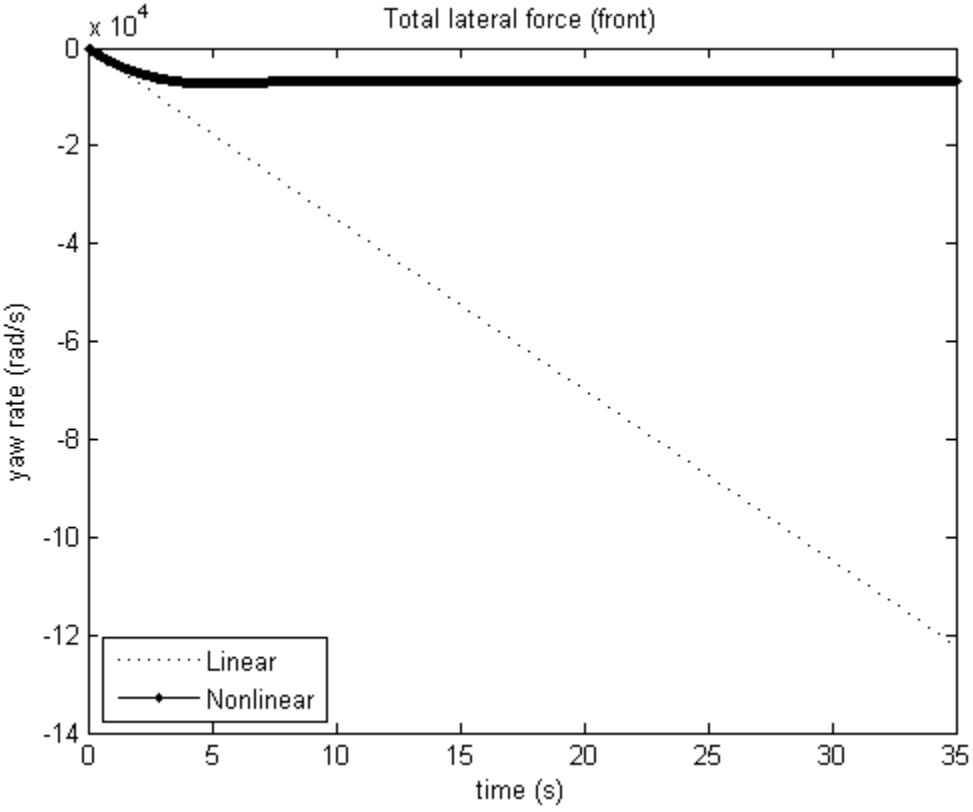
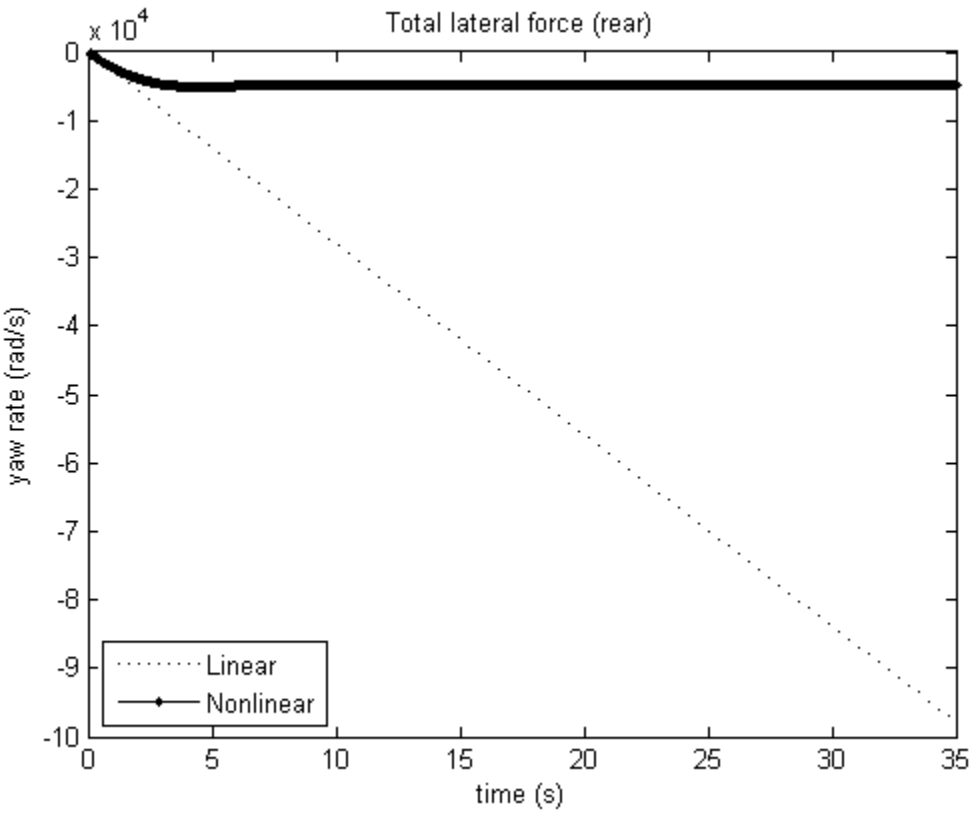
Script for 2011 ME227 HW 1 Problem 2

Author: Ruslan Kurdyumov Date: April 6, 2011

(2.1) Linear & Nonlinear tire curves (Lateral force vs. slip angle)





(2.2) Check tire curves

a. The curves look smooth and don't have sudden jumps

b. The initial slopes are fairly close:
Front linear slope (N/deg):
-30.4617

Front nonlinear slope (N/deg), 0-1 deg:
-26.2394

Rear linear slope (N/deg):
-24.3694

Rear nonlinear slope (N/deg), 0-1 deg:
-20.5459

c. The final force values match exactly:
*Expected final Fyf = -mu_s*b/2L*mg:*
-3.3817e+003

Actual final Fyf:
-3.3817e+003

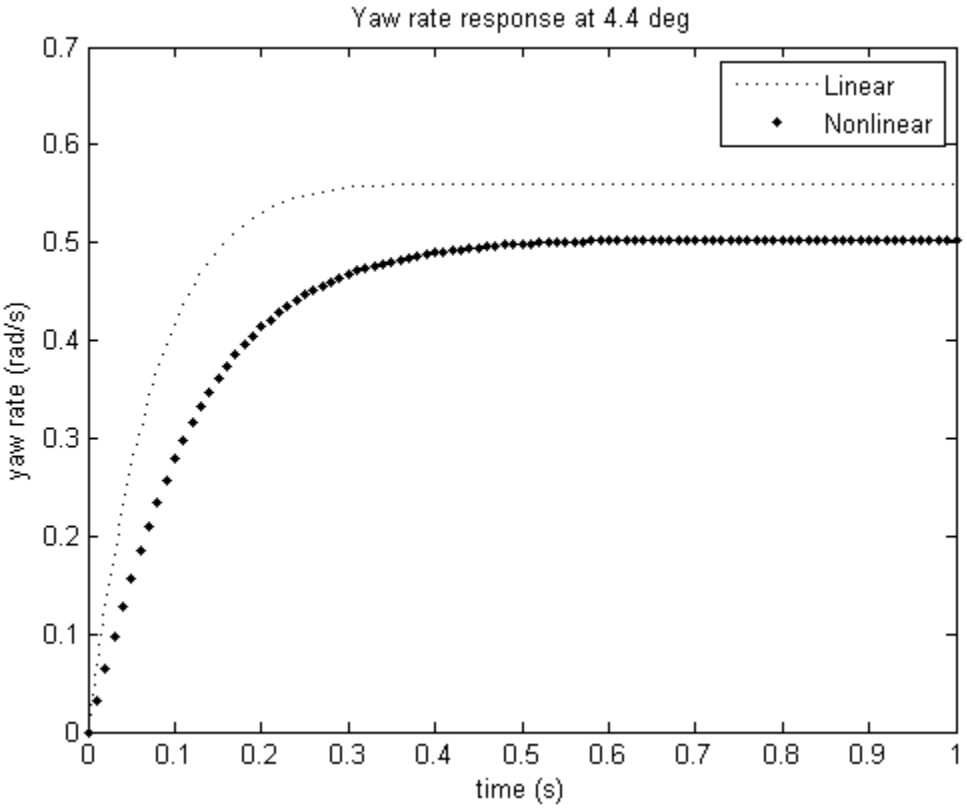
*Expected final Fyr = -mu_s*a/2L*mg:*
-2.3744e+003

Actual final Fyr:
-2.3744e+003

(2.3) Linear vs. nonlinear yaw rate response

```
Lateral acceleration (linear) at 4.4 degrees:
   11.2062

derived from a_y = U_y' + r*U_x
```



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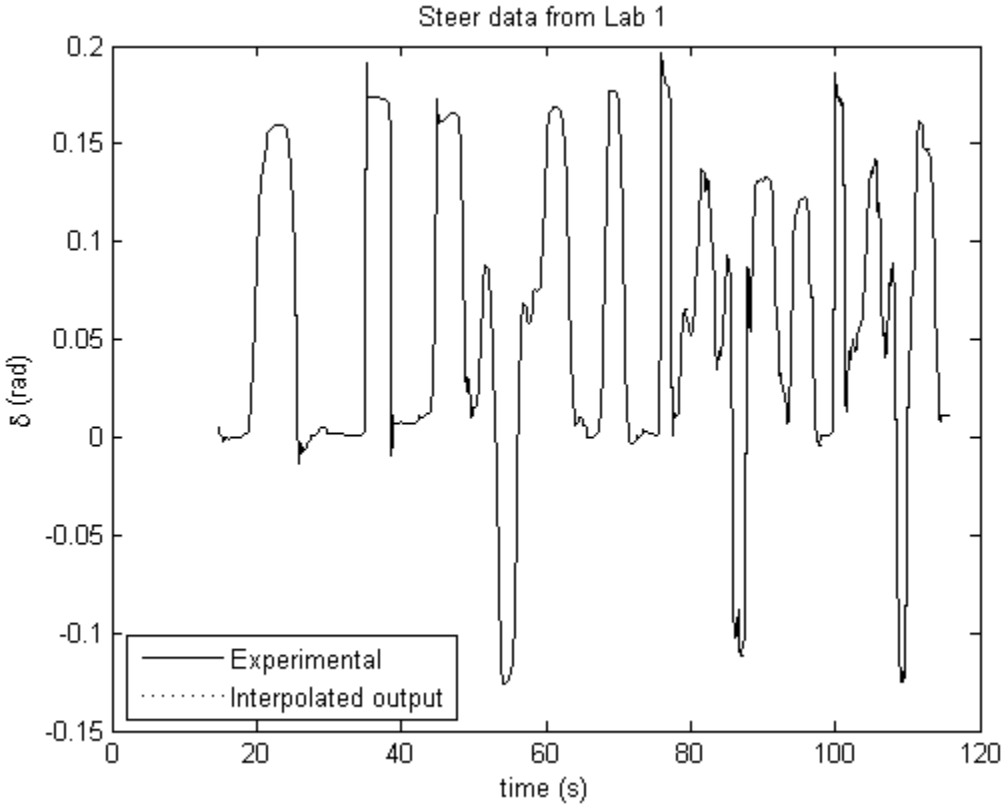
Script for 2011 ME227 HW 1 Problem 3

Author: Ruslan Kurdyumov Date: April 6, 2011

(3.1) Check steering function

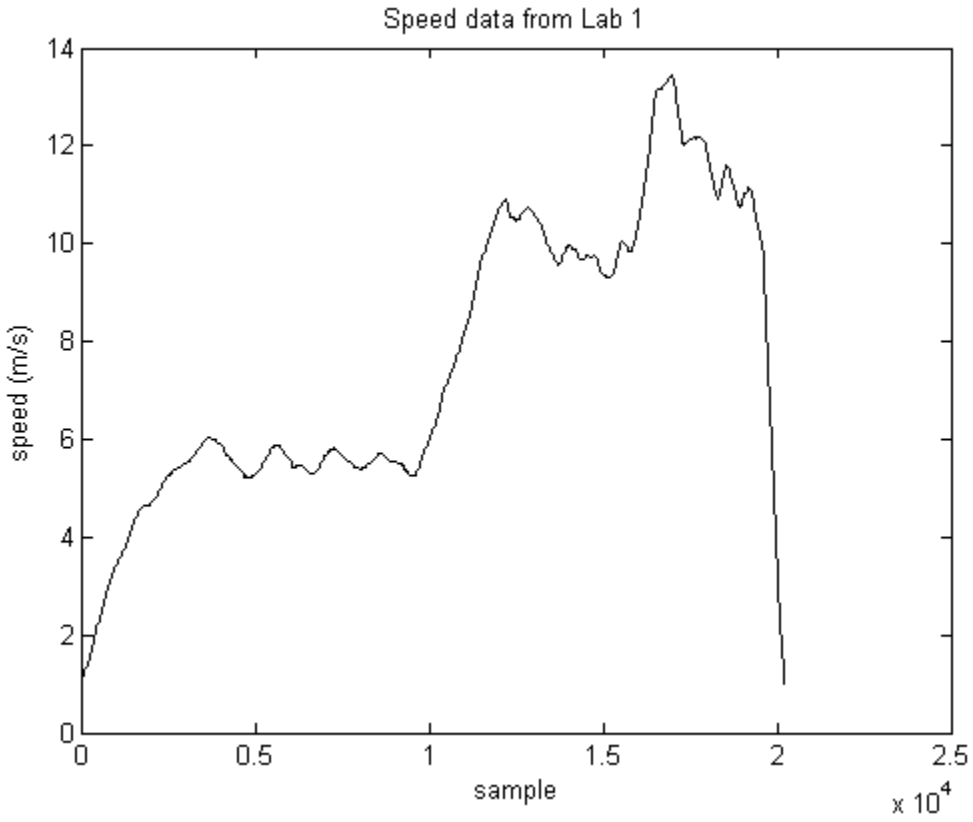
The experimental and interpolated plots match:

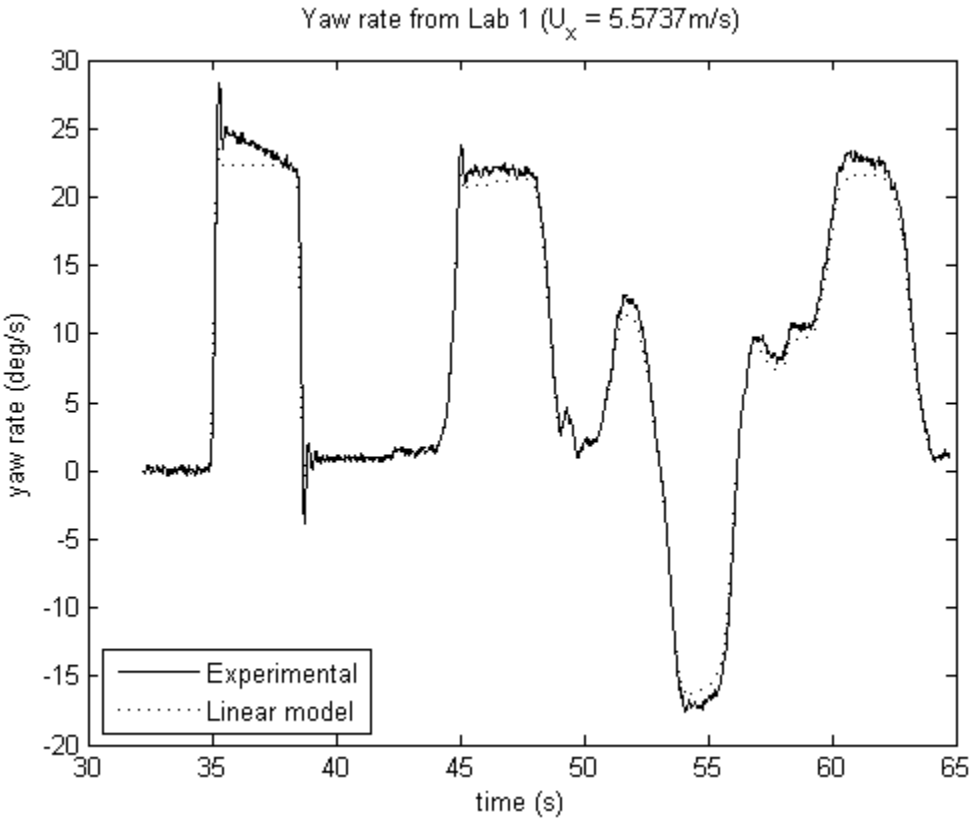


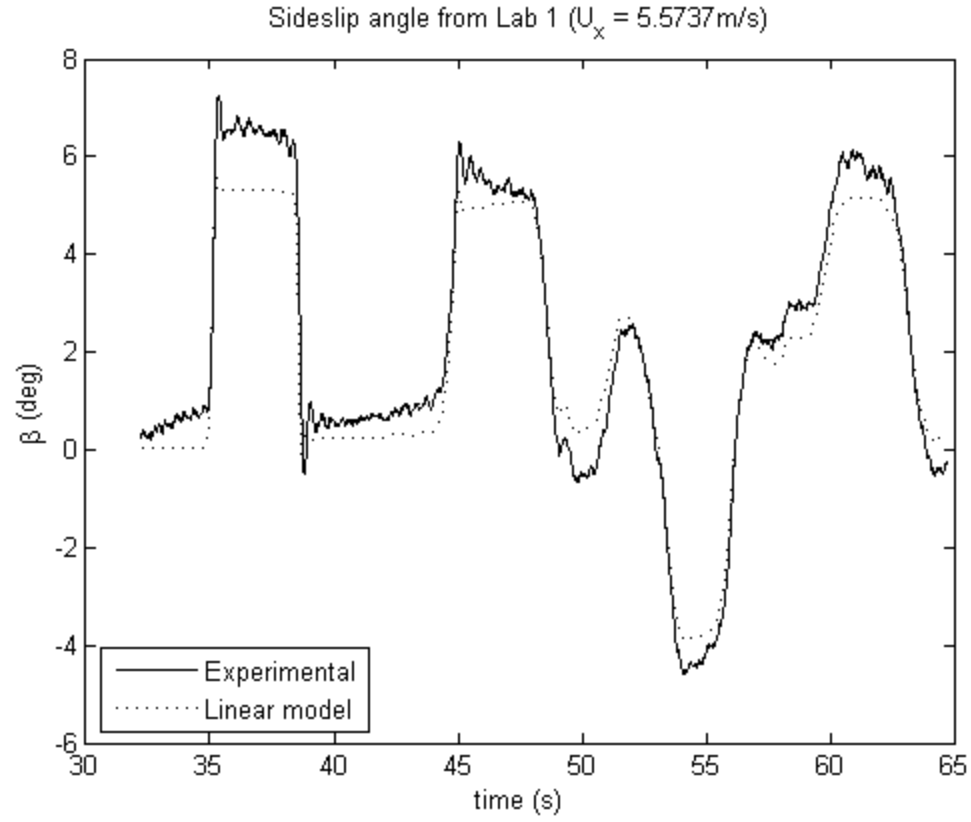
(3.2) Experimental vs. linear model yaw rate and side slip (flat section)

The experimental and linear results match fairly closely

We chose to use data from samples 3500 to 10000 with an average speed 5.5737m/s

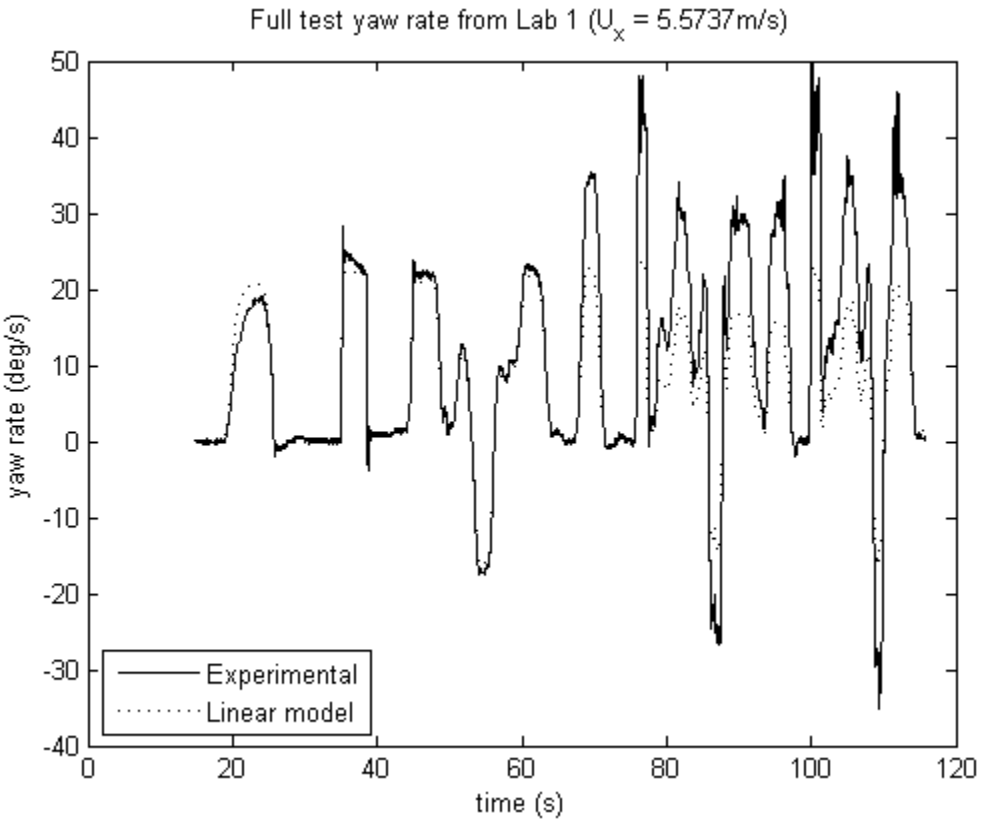


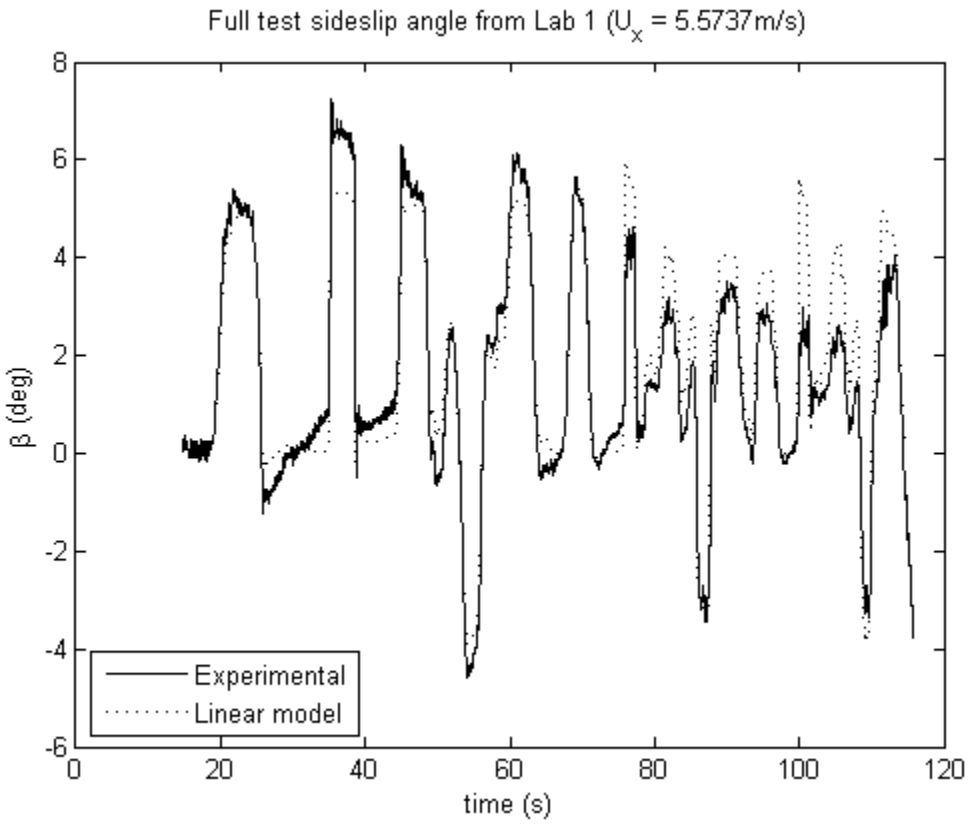

Yaw rate from Lab 1 (U_x = 5.5737m/s)
yaw rate (deg/s)
time (s)
Experimental
Linear model


Sideslip angle from Lab 1 (U_x = 5.5737m/s)
β (deg)
time (s)
Experimental
Linear model

(3.2) Experimental vs. linear model yaw rate and side slip (entire test)

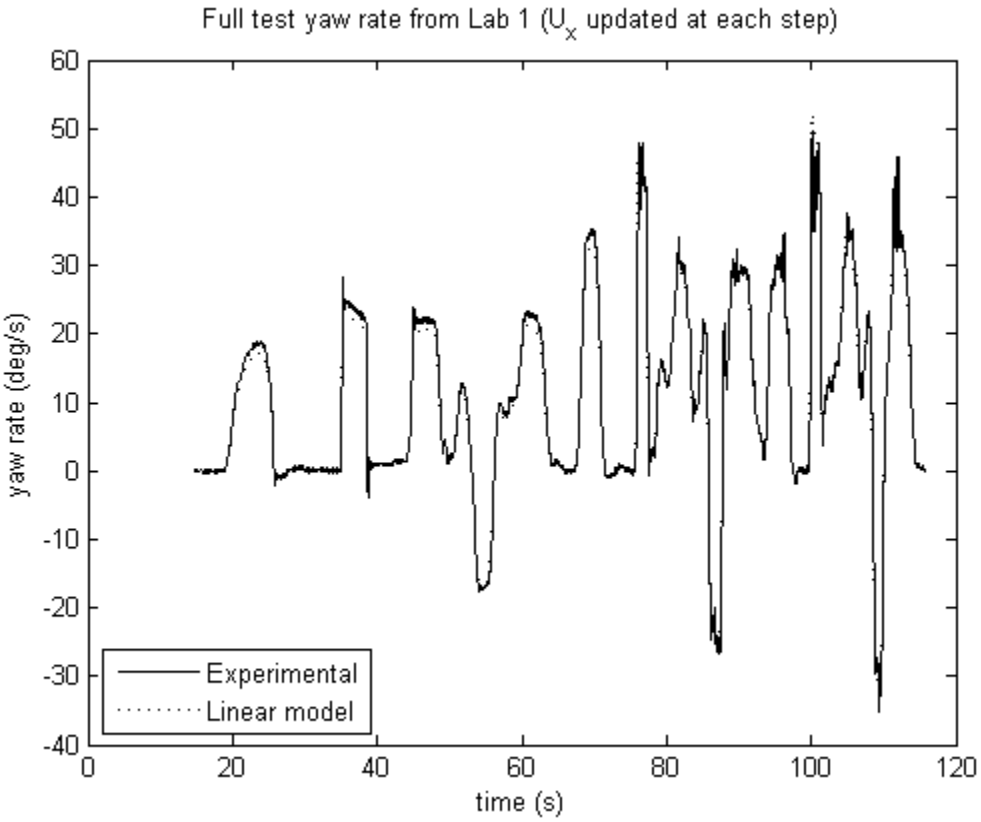
The experimental and linear results match, but we have more discrepancy:

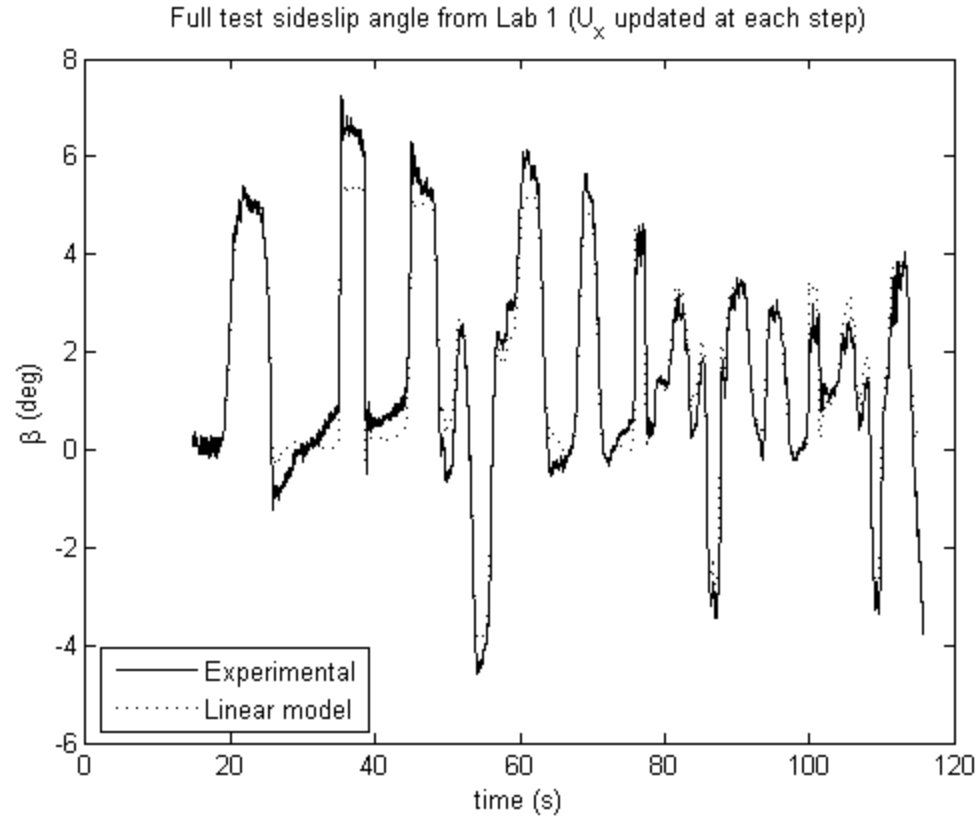




(3.3) Experimental vs. linear model yaw rate and side slip (vary Ux)

It is important to consider the speed variation, since the model is much more predictive when we consider it:


Full test yaw rate from Lab 1 (U_x updated at each step)
yaw rate (deg/s)
time (s)
Experimental
Linear model


Full test sideslip angle from Lab 1 (U_x updated at each step)
β (deg)
time (s)
Experimental
Linear model