

## # System 1D - NonLinear.

① est\_A\_m.py

Preparing data by differentiating  $\theta$  &  $\phi$

② est\_A\_mz.py

Using PCA, Least-Squares estimation to finding  $a_1, a_2 \dots$  etc constants of A matrix.  
from a file containing all the required data  
here  $u = 0$  in all data files.

eg: FT\_ME\_R5-53Z.csv  
(z = zero u)

Columns are:  $\theta, \dot{\theta}, \phi, \dot{\phi}, u_l, u_r, \text{timestamp},$   
time-absolute,  $\dot{\theta}_{smooth}, \dot{\phi}_s, \ddot{\theta}, \ddot{\phi}, \ddot{\theta}_s, \ddot{\phi}_s, \ddot{\theta}_{ss}, \ddot{\phi}_{ss}$

③ non\_linear\_solver.py

Code to estimate parameters using non-linear optimization

④ kalman.py = Using Kalman filtering to differentiate  
as against numerical differentiation.