$$\dot{z}_p = -L_p z_p - L_p [L_p \dot{p} + G + \frac{1}{m} U_p]$$

$$\dot{d}_p = z_p + L_p \dot{p}$$

Non-Linear Disturbance Observer

 $\dot{z}_{\Theta} = -L_{\Theta}z_{\Theta} - L_{\Theta}[L_{\Theta}\dot{\Theta} + \Phi(\Theta, \dot{\Theta}) - U_{\Theta}]$

 $\hat{d}_{\Theta} = z_{\Theta} + L_{\Theta}\dot{\Theta}$

$$\dot{z}_{\Theta} = -L_{\Theta}z_{\Theta} - 1$$
 $\hat{d}_{\Theta} = z_{\Theta} + L_{\Theta}\dot{\Theta}$

$$\hat{d}_p = z_p + L_p \dot{p}$$

$$\dot{z}_{\Theta} = -L_{\Theta} z_{\Theta} - L_{\Theta} [L_{\Theta} \dot{\Theta} + \Phi(\Theta, \dot{\Theta}) - U_{\Theta}]$$

Super-Twisting Observer

 $\dot{z}_p = -L_p z_p - L_p [L_p \dot{p} + G + \frac{1}{m} U_p]$