

IMU Data
Input
($\mathbf{a}_k, \boldsymbol{\omega}_k$)

\mathbf{u}_k

EKF
Initialization

($\boldsymbol{\mu}_0, \mathbf{P}_0$)

Project into
 $K + 1$

a "Posteriori"
($\boldsymbol{\mu}^+, \mathbf{P}^+$)

$$\mathbf{F}_k = \left(\frac{\partial \mathbf{f}}{\partial \mathbf{x}} \right)_{\boldsymbol{\mu}_k^+}$$

$$\boldsymbol{\mu}_{k+1}^- = \mathbf{f}(\boldsymbol{\mu}_k^+, \mathbf{u}_k, 0)$$

$$\mathbf{P}_{k+1}^- = \mathbf{F}_k \mathbf{P}_k^+ \mathbf{F}_k^T + \mathbf{Q}_k$$

a "Priori"
($\boldsymbol{\mu}^-, \mathbf{P}^-$)

$$\mathbf{H}_k = \left(\frac{\partial \mathbf{h}}{\partial \mathbf{x}} \right)_{\boldsymbol{\mu}_k^+}$$

$$\mathbf{K}_k = \mathbf{P}_{k+1}^- \mathbf{H}_k^T (\mathbf{H}_k \mathbf{P}_{k+1}^- \mathbf{H}_k^T + \mathbf{R}_k)^{-1}$$

$$\boldsymbol{\mu}_{k+1}^+ = \boldsymbol{\mu}_{k+1}^- + \mathbf{K}_k (\mathbf{y}_k - \mathbf{h}(\boldsymbol{\mu}_{k+1}^-, 0))$$

$$\mathbf{P}_{k+1}^+ = (\mathbf{I} - \mathbf{K}_k \mathbf{H}_k) \mathbf{P}_{k+1}^-$$

Kinematics Data
Measurement
($\mathbf{q}, \dot{\mathbf{q}}$, contact-array)

\mathbf{y}_k

