UKF notes

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October 15, 2021

This document is to note down what I have done during working on this assignment.

1 UKF initialization

1.1 Variance and Standard deviation

First thing we need to do is initialize the UKF class. Process noise in this project consisted of:

- longitudinal accelation (aka. linear accelation), represent as variance σ_a^2 with unit $\frac{m^2}{s^4}$ or as standard deviation σ_a with unit $\frac{m}{s^2}$
- yaw accelation (aka. angular acceleration), represent as variance $\sigma_{\ddot{\varphi}}^2$ with unit $\frac{rad^2}{s^4}$ or as standard deviation $\sigma_{\ddot{\varphi}}$ with unit $\frac{rad}{s^2}$

In the lesson, suggested starting value for linear accelation varince is $\sigma_a^2 = 9\frac{m^2}{s^4}$ which means we expected linear accelation within range $\pm 2\sigma_a$ or from $-6\frac{m}{s^2}$ to $6\frac{m}{s^2} \rightarrow \sigma_a = 3$.

For angular acceleration I would start with $\sigma_{\ddot{\varphi}}^2 = 1.5\frac{rad^2}{s^4}$ or from $-1.22\frac{rad}{s^2}$ to $1.22\frac{rad}{s^2} \rightarrow \sigma_{\ddot{\varphi}} = 1.22$.

1.2 State dimension and lambda

$$Statevector, x = \begin{bmatrix} p_x \\ p_y \\ v \\ \varphi \\ \ddot{\varphi} \end{bmatrix}$$

Therefore, number of state, $n_x = 5$.

For augmented state, we taken process noise into account:

$$Augmentedstatevector, x_{aug} = \begin{bmatrix} p_x \\ p_y \\ v \\ \varphi \\ \ddot{\varphi} \\ \nu_a \\ \nu_{\ddot{\varphi}} \end{bmatrix}$$

Therefore, number of augmented state dimention, $n_{aug} = 7$.

Lambda, λ, is a design parameter with a rule-of-thumbs $\lambda = 3 - n_x$

1.3 Accents

$$a^2 + b^2 = c^2 test \tag{1}$$

1.4 Dollar signs