Websites

* Wikipedia: product of two random variables: <https://en.wikipedia.org/wiki/Distribution_of_the_product_of_two_random_variables>
* Example process noise derivation for constant acceleration model: <https://www.kalmanfilter.net/covextrap.html>
* Variance and mean laws: <http://www.kaspercpa.com/statisticalreview.htm>
* Mean and variance after squaring a distribution: https://www.quora.com/What-happens-to-the-mean-and-variance-of-a-random-variable-when-its-squared

Definitions

* E(x) – expected value of random variable x
* μx – symbol for mean of x. E(x) = μx
* V(x) – variance of random variable x
* σ2x – symbol for variance of x. V(x) = σ2x

**Continuous Process Noise**

Quaternion states

* = V(A) + V(B) + V(C) + 2COV(A,B) + 2COV(B,C) + 2COV(A,C)
* **+ + + +**
* **+ + +**
* **+ +**
* **+ +**

Velocity states

**Discrete Process Noise**

Delta Angle Variance

Goal: Given variance of gyroscope, V(gx), V(gy), V(gz), determine V(Δθx), V(Δθy), V(Δθz), V(Δθ), where

1. Let’s call = Si. V(Si) =
   1. Note Δti = Δt. (Δt1=Δt2=Δt3, etc.)
   2. Note .
   3. So, V(Si) = V(S). (V(S1) = V(S2) = V(S3), etc.)
2. = = V(S1) + V(S2) + … V(SN) = N\*V(S) = N\*Δt2\*V(gx)
   1. Assuming any two samples of the gx are statistically independent
   2. **N = ΔtNavigation/ΔtIMU**
3. E(Δθx) = E( = Δt(E( + E( + … E(
   1. Given a sample , what is E()?
      1. Assume
         1. **Ε(Δθx) = Δθx**
      2. Assume
         1. Ε(Δθx) =
         2. **Ε(Δθx) =**
4. **= (V(Δθx) + Ε(Δθx)2)2 - Ε(Δθx)4**