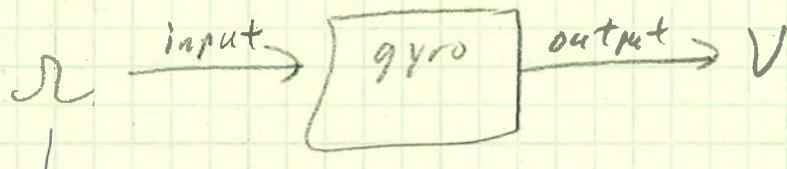


1. Allan Variance

- A statistical measure of frequency stability. Used in evaluating devices such as clocks, oscillators and gyroscopes
- Seldom "directly" seen on a data sheet
- May be used in calculating some of the metrics previously discussed

a. background

Consider the rate gyro



$$\text{deg/s} \times \frac{1\text{period}}{360^\circ} = \frac{1}{s} = \text{Hz}$$

∴ the R is a frequency

$V_{out} \propto R$ or frequency

∴ a rate gyro is sort of a Fourier Transform device

∴ for a zero or constant R input, the variation in V_{out} reveals information on the stability of the "transform" or gyro R to V process

∴ V_{out} is sort of a frequency measurement

b. Calculating the Allan Variance

→ Let T be a cluster time, a block of V_{out} samples

→ collect n blocks of V_{out} clusters, of equal length

→ average V_{out} of each cluster : $\bar{V}_{out1}, \bar{V}_{out2} \dots \bar{V}_{outn}$

Define the Allan variance, $\sigma_{V_{out}}^2$, where (no gaps
in between)

$$\sigma_{V_{out}}^2 = \frac{1}{2} (\bar{V}_{outT+1} - \bar{V}_{outT})$$

The variance of the set of consecutive differences,

$\{\sigma_{V_{out1}}^2, \sigma_{V_{out2}}^2, \dots, \sigma_{V_{outn}}^2\}$ is called the Allan variance for cluster time, T .

The square root of this quantity is called the Allan deviation for cluster time, T

The plot of the Allan deviation vs. cluster time is called the "green chart" or an "Allan Deviation chart"

Individual noise processes can be distinguished on an Allan deviation chart by their characteristic slope on a log-log plot :

<u>Noise Process</u>	<u>Characteristic Slope</u>
Random Walk	0.5
Flicker	0
White Noise	-0.5
Super Flicker	-1
Super White	-1.5

Websites for Allan Variance Information

- 1) http://itl.nist.gov/div898/software/dataplot/refman1/ch2/allan_var.pdf
- 2) <http://www.allanstime.com/AllanVariance/>