

Re: Q about noise in time interval measurement averaging

Source: <http://sci.tech-archive.net/Archive/sci.electronics.design/2007-04/msg01207.html>

- *From:* bill.sloman@xxxxxxxx
 - *Date:* 6 Apr 2007 16:31:20 -0700
-

On Apr 6, 8:42 pm, "colin" <colin.ro...@xxxxxxxxxxxxxxxxxxxxxx> wrote:

Hi,
I have a PIC measuring a time interval to 25ns resolution,
the interval is totally asynchronous to the PIC clock.

So say if I average over 25000 measurements that will give me a limit of 1ps resolution.

Im trying to do a system noise analysis and im wondering how to work this out,
I cant seem to recall how the noise reduces with increasing samples,
is it 1/samples ? this would be too good to be true,
or $1/\sqrt{\text{samples}}$ this seems rather low.

Noise decreases as one over the square root of the number of samples,
if the noise on successive samples is uncorrelated.

The square root of 25000 is 158.1, so you'd reduce your 25nsec quantisation error to 158psec rather than 1psec, if you averaged 25000 independent samples.

there is also a lot of noise in the signal as it is from an optical encoder,
seems mostly mechanical, I need to reduce this by averaging over a long time too.

I'm trying to work out the optimum rate of pulses per revolution to use.

The optimum number of pulses per revolution is probably one, unless
your need to know the sense of the rotation as well as it's speed.

--

Bill Sloman, Nijmegen

Re: Q about noise in time interval measurement averging