

Re: Do you think NI can fix my PLL? -- Details

Source: <http://sci.tech-archive.net/Archive/sci.electronics.design/2006-06/msg00665.html>

- *From:* Tim Wescott <tim@xxxxxxxxxxxxxxxxxxxx>
 - *Date:* Sat, 03 Jun 2006 14:30:43 -0700
-

CC wrote:

Tim Wescott wrote:

CC wrote:

3. For a PLL, one is usually controlling a VCO, which produces a frequency (speed) directly proportional to input voltage. One also usually expects that the VCO response, ie., the frequency response of the phase, is not burdened by zeros/poles close to the desired PLL BW, so one can treat it simply as K_{vco}/s .

If a motor is put in a speed servo, then it would behave more like a true VCO than the first two cases. As long as the PLL BW was safely removed from the response rolloff (likely to be complex poles) of the speed servo, one can treat it as well as K_{vco}/s .

That's true, except that the motor's mechanical time constant is going to be pretty darn slow; unless you want to really slow down your PLL response it's going to be almost as troublesome as it would be sitting at $s = 0$ in your current drive case.

But a linear system is at least a linear system. Basically, there needs to be some plan for elucidating if what I have at present is just a mediocre motor characterization, poor choice of loop compensation, or trouble with the slight nonlinearities of the drive.

Can you say anything from experience about the implications of "slight nonlinearities" such as let's say a -25%/+50% variation in DC transfer gain, coupled with a 10-20% variation in transient response on the rising edge vs. the falling? Does it seem that such nonlinearities would make it impossible to get a decent loop going?

Re: Do you think NI can fix my PLL? -- Details

Those should be quite easy, if that's all that's going on. You'd have to make somewhat conservative loop tuning, but you wouldn't have to back it off that much. The real question is how jitter do you get running open loop compared to what you get in closed loop. If you're not getting any significant jitter at all then you should be able to make a really slow loop and be done with it.

If you are getting open loop jitter you need to deal with it. Then you need to ask what the frequency content of the jitter is, what the achievable bandwidth of the loop is, and what (if anything) you can do to reduce the amplitude of the jitter.

-- snip --

--

Tim Wescott
Wescott Design Services
<http://www.wescottdesign.com>

Posting from Google? See <http://cfaj.freeshell.org/google/>

"Applied Control Theory for Embedded Systems" came out in April.
See details at <http://www.wescottdesign.com/actfes/actfes.html>

.