Ultrasonic Transducer Statistics
6 May 2020

Statistics have to be correct for the Kalman filter part of the project to work.

Guidance: Ultrasonic Transducer Statics

1) Build a working system with the Arduino that can display the distance of the ultrasonic transducer with respect to a fixed target.
    a. You must use something like the fixtures from Ed on the 2nd floor window.
    b. Try multiple distances in the operating range. Compare result with measurement from a rule.
    c. You need a sway to save multiple measurements of the same distance – writing the to the console and cutting and pasting is fine
    d. Other approaches such as connecting the Arduino to Matlab are also acceptable
    e. This is a good time to get a calibration curve pulse width vs distance in inches or cm. See file "Ultrasonic_Transducer_Tests" for a formula and website. Note there may be an offset. It is suggested to plot known disatance bs pulse witdth as a start

2) The results should show some vairation – i.e. if you take 100 numbers at the same location they should not all be same. You may have to adjust the resolution of timers etc.

    a. If you had a scope variance is easily measured in the analog domain. Thiw was discussed in lecture
    b. SAVE THIS DATA – you need it later

3) The transducer is sensitive to ambient conditions. For a given setup say 2 inches, if you fan air or exhale breath between the sensor and target the answer should change, it may take some time to go back to the nominal value. We will not worry about thi in the calibration – just observe it

4) You should do this for at least 3 sensors and rank them by variance\

5) Plot the histogram a few set of measurements in Matlab and see if it looks gaussian. Pick only one or two distances but do the 3 different sensors

6) Relate to the formula with calibration and +/- 3 standard deviation.

At the end of this part you should have

- Calibration curve for each sensor (tested against real measurements
- Statistics for measurement variance (both in pulse width and in inches