Gyroscope Test Plan

Objective

The purpose of this plan is three fold, firstly to determine if the gyroscope is outputting data when it should, secondly to make sure the data is correct, and thirdly to make sure that the low pass filter on the gyroscope is working. It is also an exercise to make sure that the processor and the gyroscope can talk to each other, and that the processor can make sense of the data.

Procedure

Testing whether or not the gyroscope is responding to movement is a simple matter. An oscilloscope is placed on the data line of the gyro's I^2C outputs, then power is applied. The gyroscope is to be placed on a table so that it is not moving and a steady output can be read over the data line. The gyroscope is then moved rapidly and a change in the output would indicate that the gyro is sensing the movement and then outputting accordingly.

To make sure that the data is correct the gyro is to be hooked up to the processor and the processor loaded with a program that simply records the output data of the gyroscope. Then the gyro is put onto the test bench and vibrated at a known frequency and amplitude. The data from the gyro is sent to the processor and integrated so that a graph of angular position over time can be generated in MATLAB.

Finally to make sure that the low pass filter is working the gyroscope is to be shaken randomly by hand as to generate a signal with large frequency content. This data is then send to the processor to be integrated and recorded (using the same program as the previous test). The data is then imported into MATLAB and a Fourier Transform is carried out and the result plotted.

Analysis

The first test is straight forward to interpret, if the data changed when the gyroscope is shaken, then it can be assumed that the change was due to the shake and therefore the gyroscope is responding to physical input.

The second test is a little more involved than the first, but is by no means difficult. Once the data is extracted from the processor, it is imported into MATLAB and is graphed against time to ensure that it has the correct frequency and amplitude, namely those of the test rig. The data will not be time stamped, but the sample frequency of the gyroscope is know so that can be used to generate a time vector in MATLAB which can be used to graph the integrated gyro output against.

The third test is very similar to the second in that the processor needs to integrated the gyroscope data and then it must be extracted and loaded onto the computer. Once in MATLAB the data can then have a Fourier transform applied, and then graphed as a function of frequency. Since the gyroscope was shaken randomly there is a high chance that there is high frequency content in the physical motion of the gyro. Once the Fourier transform of the data is plotted in MATLAB there should not be frequency content above 30 Hz. If this is true then the LPF on the gyro is working, if not then the LPF is either not working or was not set properly.