Class Report 4: Inclination

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1   Introduction

In this project the SPI core was utilized to interface with the Nexys 4 board's ADXL362 accelerometer. The internal registers of the ADXL362 store the acceleration data, part configuration, and status and can be accessed according to its custom protocol. By initiating a read transaction for a multi-byte operation, the X, Y, and Z acceleration data is retrieved via the SPI bus and translated to the boards seven-segment display to show its orientation. Source files for SystemVerilog and C++ can be found here and a video demonstration here.

2   Implementation

For this demonstration, the SPI bus operating mode and frequency were set to 0 and 400kHz. A read transaction was then initiated by first asserting the select line, telling the ADXL362 that it is the peripheral being spoken to. The custom protocol defined by the device then dictates that the controller send a 'read instruction' byte, 0x0b, and then the register address to be read. Once the ADXL362 has been instructed that a read operation is taking place the controller transmits an arbitrary message that elicits a response containing the accelerometer data from the device. Because the ADXL362 performs automatic address incrimination, this process is repeated a total of three times in succession before the controller deasserts the select line. The X, Y, and Z accelerometer data are then translated to two sseg units by checking for a positive or negative value in each axis and turning on the corresponding LEDs. The achieved effect is that the orientation of the board will cause the lit LED segments to "fall" to the physically lowest position. There is no design sketch for the circuit because the SPI core implementation is already provided and simply utilized to interface a peripheral.