DSP User Interface
With
Simulink

Date:
12/11/03

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Memo: Complete System Level Block Diagram
Description:
Quadrature amplitude modulation (QAM) is an encoding scheme where digital data is mapped to an analog signal consisting of 2 carriers, \(\sin(2\pi f t)\) and \(\cos(2\pi f t)\), at different phases (multiples of 45°). A continuous data stream can be encoded and represented on a 3-bit table and therefore an 8-point signal constellation. See Fig 1.

![Signal Constellation](image)

Simulink:
The Senior Capstone project will consist of a QAM problem and the implementation of Simulink and DSP. Simulink can be used as a powerful tool to tackle very complex problems involving everything from controls to DSP. Simulink is a program that allows the user to manipulate signals with the use of icons or blocks, which in turn works with Matlab to create a signal processing circuit. These icons or blocks symbolize anything from filters to mathematical functions. After completing the desired signal processing circuitry, Simulink writes C++ code to the Texas Instruments’ TMS320C6711 DSP board. The DSP board has A/D and D/A ports to allow for sending in a signal and retrieving the processed signal.

Method:
The method of QAM will consist of bit masking and bit mapping. A 16-bit will enter the DSP board via the A/D port. The least significant bit will be ignored, due mostly to noise. The remaining 15 bits will be masked off to 5, 3-bit packets of binary numbers. These packets will then be mapped to the signal constellation, as shown in Fig 1. Then the various signals will be sent out over the D/A port on the DSP board, and received by outside hardware (most likely a phase lock loop). All of this will hopefully be accomplished through Simulink code. Fig 2 shows the System Level Block Diagram.
Fig 2 shows the System Level Block Diagram of the QAM project. The 1st block represents the conversion of the incoming analog signal to digital. In the 2nd block, the 16-bit signal gets broken up into useable 3-bit packets. The 3rd block represents the signal constellation. Each binary packet, 000-111, will be mapped to a point on the signal constellation consisting of Sine and Cosine functions. The Simulink code will then generate the appropriate signal by constructing the coded information in the 4th block, and as the 5th block shows, the data will leave the DSP board via the D/A converter.