DSP Based Laboratory System for Exploring Communication Engineering Concepts

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Abstract— This title represents that communication engineering has been used in many fields. One problem with communication laboratories is the lack of flexibility. Current laboratories either use specialized equipment with little or no ability to change system parameters or extremely general equipment with limited modulation types and pulse shaping options. This can discourage students from further exploration because of the apparent irrelevance to real world problems. A common solution is to provide a hands-on laboratory to illustrate applications of abstract concepts. One solution to this problem is to use digital signal processing techniques. DSP systems are extremely flexible and provide the ability to implement a wide range of modulation types and pulse shapes.

And so here we will implement all the communication engineering concepts on TMS320C6713 by developing the algorithms, compiling them on CCS, and implement it on TMS320C6713.

General Terms: Digital Signal Processing (DSP), Code Composer Studio (CCS), DSK6713

Keywords: CCS, PAM, PSK, BPSK

I. INTRODUCTION

One of the major problems with communication engineering laboratories is the lack of flexibility available in the lab equipment. This lack of flexibility stems from the inability to mix different modulation types and pulse shapes. Current laboratory systems often provide a single modulation and pulse type that cannot be changed without extensive hardware manipulation, or a limited number of modulation techniques with a single pulse shape. The system described in this paper is a solution to this problem which allows for multiple modulation types and pulse shapes by applying the flexibility of digital signal processing (DSP) to the generation communication signals.

Fig. 1: Block diagram of TMS320C6713 DSK

DSP processors are concerned primarily with real-time signal processing. Real time processing requires the processing to keep pace with some external event, whereas non-real-time processing has no such timing constraint. The external event to keep pace with is usually the analog input. Whereas analog-based systems with discrete electronic components such as resistors can be more sensitive to temperature changes, DSP-based systems are less affected by environmental conditions. DSP processors enjoy the advantages of microprocessors. They are easy to use, flexible, and economical. Digital signal processors such as the TMS320C6713 is like fast special-purpose microprocessors with a specialized type of architecture and an instruction set appropriate for signal processing.

A. TMS320C6713 DSK

The C6713 DSK is a low-cost standalone development platform that enables users to evaluate and develop applications for the TI C67xx DSP family. The DSK also serves as a hardware reference design for the TMS320C6713 DSP. Schematics, logic equations and application not are available to ease hardware development and reduce time to market.

B. Code Composer Studio (CCS)

CCS provides an IDE to incorporate the software tools. CCS includes tools for code generation, such as a C compiler, an assembler, and a linker. It has graphical capabilities and supports real time debugging. It provides an easy-to-use software tool to build and debug programs.

II. PULSE AMPLITUDE MODULATION

PAM uses the amplitude of the pulse to convey the information while other parameters such frequency remains fixed. The incoming bit stream is grouped into J-bit words such that 2^J levels are uniquely assigned to them. With increasing J, the number of possible levels also increases.

Fig. 2: 8-level PAM constellation diagram

For example with J=2, there are 4 levels and with J=3, there are eight levels possible. These levels when mapped on the constellation diagram are equidistance from each other and centered across the zero. For J=3, eight constellation points representing levels are shown in the figure 2.1. These levels are then mapped into train of pulses such that amplitude of these pulses represent one-to-one mapping of
information symbols to the respective levels of pulse. At the receiver the information sequence is retrieved back by mapping the pulse amplitude to the information symbol.

IV. CONCLUSIONS

The proposed Communication Engineering based on DSP has the advantages of high speed, more efficient result and more flexible.

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