20EC57L
Digital Signal Processing Lab

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- Digital signal processing is one of the core technologies, in rapidly growing application areas, such as wireless communications, audio and video processing and industrial control.
- The number and variety of products that include some form of digital signal processing has grown dramatically over the last few years.
- DSP has become a key component, in many of the consumer, communications, medical and industrial products which implement the signal processing using microprocessors, Field Programmable Gate Arrays (FPGAs), Custom ICs etc.
- Due to increasing popularity of the above mentioned applications, the variety of the DSP-capable processors has expanded greatly.

- DSPs are processors or microcomputers whose hardware, software, and instruction sets are optimized for high-speed numeric processing applications, an essential for processing digital data, representing analog signals in real time.
- The DSP processors have gained increased popularity because of the various advantages like reprogram ability in the field, cost-effectiveness, speed, energy efficiency etc.
- Digital signal processors such as the TMS320C6x (C6x) family of processors are like fast special-purpose microprocessors with a specialized type of architecture and an instruction set appropriate for signal processing.

- The C6x notation is used to designate a member of Texas Instruments' (TI) TMS320C6000 family of digital signal processors.
- The architecture of the C6x digital signal processor is very well suited for numerically intensive calculations. Based on a very-long-instruction-word (VLIW) architecture, the C6x is considered to be TI's most powerful processor.
- Digital signal processors are used for a wide range of applications, from communications and controls to speech and image processing. The genera l-purpose digital signal processor is dominated by applications in communications (cellular).
- Applications embedded digital signal processors are dominated by consumer products.

- They are found in cellular phones, fax/modems, disk drives, radio, printers, hearing aids, MP3 players, high- definition television (HDTV), digital cameras, and so on.
- These processors have become the products of choice for a number of consumer applications, since they have become very cost-effective.
- They can handle different tasks, since they can be reprogrammed readily for a different application.
- SP techniques have been very successful because of the development of low-cost software and hardware support

- For example, modems and speech recognition can be less expensive using DSP techniques.
- 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 touse, flexible, and economical

Advantages of DSP's over Analog Circuits

- Can implement complex linear or nonlinear algorithms.
- Can modify easily by changing software.
- Reduced parts count makes fabrication easier.
- High reliability.

Difference between DSPs and Other Microprocessors

- DSPs are designed to perform the mathematical calculations
- needed in Digital Signal Processing.
- The execution speed of most of the DSP algorithms is limited almost completely by the number of multiplications and additions required.
- DSPs can also perform the tasks in parallel instead of serial in case of traditional microprocessors.

Importance features of DSPs

- As the DSP Processors are Designed and Optimized for Implementation of Various DSP algorithms, Most Processors Share Various Common Features to Support the High performance, repetitive, Numeric Intensive tasks.
- MACs and Multiple Execution units.
- Efficient memory access.
- Circular Buffering.
- Dedicated Address Generation Unit.
- Specialized Instruction Units.

Applications for the TMS320 Family

- **Telecommunications:** telephone line modems, FAX, cellar telephones, wireless networks, speaker phones, answering machines.
- **Voice/Speech:** Speech digitization and compression, Voice mail, Speaker verification and speech synthesis.
- **Automotive:** engine control, antilock brakes, active suspension, airbag control and system diagnosis.
- **Control systems:** head positioning servo system in disk drives, laser printer control, robot control, engine and motor control, and numerical control of automatic machine tools.
- **Military:** radar and sonar signal processing, navigation systems, missile guidance, HF radio frequency modems, secure spread spectrum radios and secure voice.

- **Medical:** hearing aids, MRI imaging, ultrasound imaging, and patient monitoring.
- **Instrumentation:** Spectrum analysis, transient analysis, signal generators.
- **Image Processing:** HDTV, image enhancement, image compression and transmission. 3-D rotation and animation.