

DSP Education at UESTC

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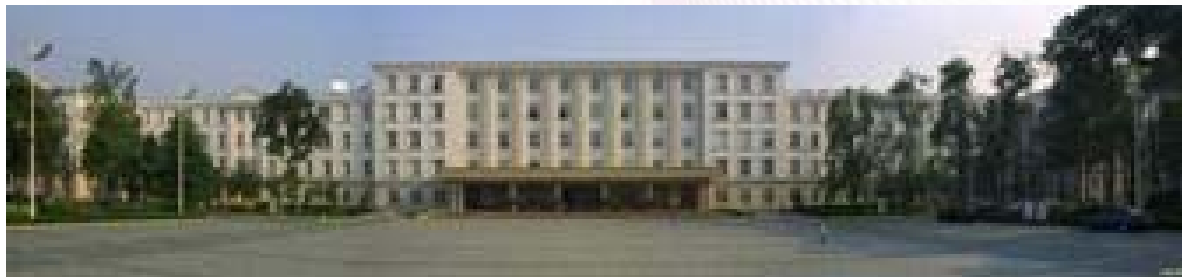
About UESTC

- UESTC (**University of Electronic Science & Technology of China**) is in Chengdu, Sichuan province, China.
- UESTC is a National Key University within the China Education Ministry
- In 1997, UESTC was included in the first group of universities in the "211 Project", a national program that promotes China's higher education (100 China universities total on the list).

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About UESTC

- In 2001, UESTC was selected as one of the Chinese universities that receive special financial support from both the Ministry of Education and the local Provincial Government (a total of 34 top China universities in the Project “985” list).



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About UESTC

- UESTC was established in 1956 by the China Government based on the famous Electronic Engineering Departments from Jiaotong University in Shanghai, South-East University in Nanjing, and South China University of Technology in Guangzhou.



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About UESTC

- UESTC is one of the top China universities in almost all of the electronic engineering areas with accomplished professors and high quality students who work in many universities, academic institutes, and industry.
- Please visit us at www.uestc.edu.cn

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UESTC-TI DSP Technical & Training Centre

- In 1997, UESTC and TI agreed to set up the UESTC-TI DSP LAB .
- In 2000, the Lab was upgraded to the UESTC-TI DSP Technical & Training Centre which is one of the three centers in China. The others are in Tsinghua University in Beijing and Jiaotong University in Shanghai.

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UESTC-TI DSP Technical & Training Centre

- Each year, more than 1,000 students, more than 300 graduate students and 600 undergraduate students take the TI DSP course and experiments in the centre.
- More than 100 industry engineers have taken the TI DSP training in this centre.
- More than 40 DSP teachers from approximately 30 universities have taken the TI DSP course and experiments training.

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UESTC-TI DSP Technical & Training Centre

- The centre works in cooperation with many famous firms to develop TI DSP solutions in wide areas of communication, radar, measure, control, and consume and so on.
- The TI DSP equipment developed by the centre have shelled to more than 40 China universities.
- The centre has become one of the most important sources of TI DSP technology and engineers in China.

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UESTC-TI DSP Lab Courses

- “Digital Signal Processing”, “DSP Technology”, “DSP Experiments” and “Implementation of DSP Projects”.
- For junior under-graduate students and first year graduate students.
- Emphasize the course “DSP Technology”

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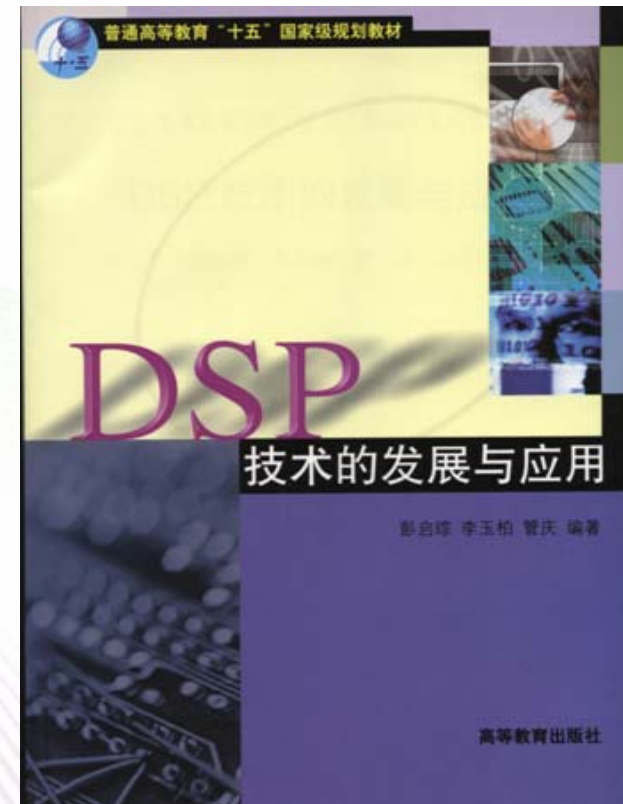
Arrangement of the Course

- All 32 hours, and other 10 hours for 2 or 3 experiments in course “DSP Technology”.
- Previous attendance in the theory courses including “Digital Circuit and Logic”, “Micro-computer Principle”, “Signal and System”, “Theory of Communication”, and “Digital Signal Processing” especially.

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About Textbook

- Textbook “***Development and Applications of DSP Technology***” by Qi-cong Peng, Yubai Li and Qing Guan, 2002.
- The 2nd edition of this textbook will be published in 2007 1Q.



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Main Reference Books



DSP Development Environment
- Application of Code Composer Studio™ IDE and DSP/BIOS™ Kernel

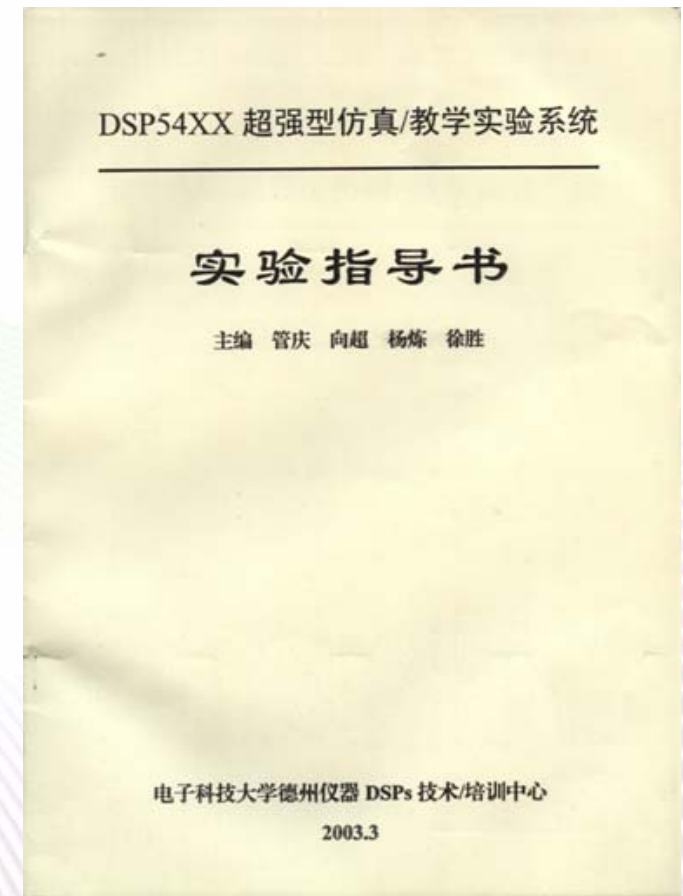


TMS320C54X™ Tutorial

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Experiment Guide

- The Guide includes contents , steps and all source codes of experiments.
- Students can master skill development through the experiments.



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DSP is Growing in Importance

- Signal processing is increasingly implemented with digital technology.
- DSP technology is being developed very quickly.
- DSP is more powerful than Analog processing in areas such as flexibility, precision, credibility ,repetition and VLSI among others.
- DSP will determine the future!

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DSP is Growing in Importance

- Industry needs more DSP engineers.
- They must be familiar with not only fundamental methods and algorithms, but also the implementation on DSP processor and SoC-based on DSP core.
- Hundreds of institutes and companies in China go to universities to seek DSP engineers each year.

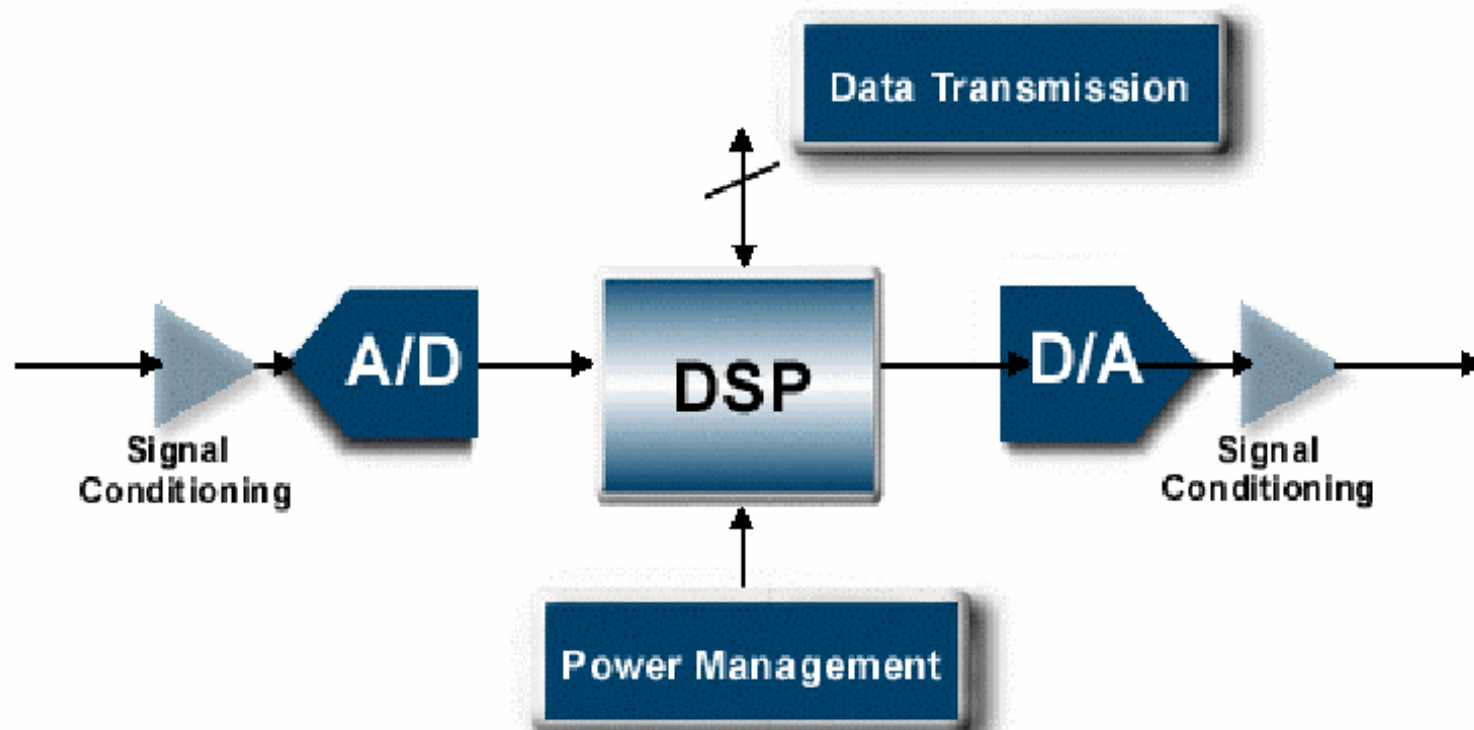
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Contents of Our Course

- We want to teach students through three aspects:
- To use TI TMS320C5400™ series DSP as example, and encircle implementing of a DSP Minimum System, we introduce architecture, instruction and developing environment.
- This forms the basic knowledge for DSP applications.

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DSP Minimum System



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Contents of Our Course

- Based on the DSP Min-System and fundamental knowledge of DSP development, we continue to introduce implementation methods of general digital signal processing algorithm.
- These algorithms include FIR, IIR, LMS, FFT and complex function approximation.

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Contents of Our Course

- In the last part of our course, we provide DSP solutions.
- For example, MPEG3 Decode, DTMF Code and Decode in telephone, AM/FM modulation in communication, and so on.
- We may explicate one example in detail and analyze how DSP codes implement the functions we want.

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Chapter of contents

- CH1: Introduction - What is DSP processor and why use them
- CH2: DSP processor architecture - Introduce TI's TMS320C2000™, TMS320C5000™ and TMS320C6000™
- CH3: DSP software system - Introduce DSP instruction set, addressing modes, and so on

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Chapter of contents

- CH4: DSP development environment - Introduce TI DSP code generation tools, Code Composer Studio™ (CCS) IDE, DSP/BIOS™ kernel and real-time operation system
- CH5: DSP peripherals, such as McBSP, DMA, HPI, Timer
- CH6: Design a DSP system - Introduce DSP hardware design and number representation, especially fixed point representation

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Chapter of contents

- CH7: Basic arithmetic - Introduce the effect of limited word length; implementation of FIR, IIR filters and FFT
- CH8: DSP applications - (1) Minimum DSP system design; (2) Adaptive filtering; (3) DTMF; (4) Digital oscillator; (5) Viterbi decoding; (6) MPEG3 player. All above applications are based on C5000™

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Exercise of Course

- Our DSP Technology course contain many exercises for students to enhance their DSP application knowledge.
- Some exercises are complicated and require two or more weeks to complete!
- Examples of these project exercises are on the following slides:

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Exercise Project 1

- Introduce the architecture and characteristics of DSP processors, and use TI TMS320C5402 as example.
- Suggest students compare the general purpose processors, like Intel® Pentium® 4 processor, with DSP, and submit a contrastive research report.
- Or, compare ADI ADSP-2191 with TMS320C5402.

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Exercise Project 2

- Introduce the DSP Min-System.
- Suggest students design a DSP Min-System and give its schematic.
- The DSP Min-System may be a signal generator, or a speech processing system, or a high speed data acquisition system, etc.

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Exercise Project 3

- Sometimes the students want to do software projects in DSP applications.
- For DTMF code and decode, we only give the source codes in CCS not in DSP/BIOS.
- Using DSP/BIOS to implement DTMF is more significant and important.
- And other exercise projects...

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DSP Experiment System

- We designed a full DSP Experiment System (called DES) which can support TI C2000™, C5000™ and C6000™ series.
- On the DES, we designed many experiment exercises for students to study DSP.
- These experiment contents are divided into four parts which will show in next slide.

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Contents of Experiment

- The first part is DSP development environment including usage of CCS and DSP/BIOS, compiler and debug tools, etc.
- The second part is DSP and its peripherals including usage of McBSP, DMA, EMIF, TIMER, etc.

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Contents of Experiment

- The third part is implementation of basic digital signal processing algorithms including FIR, IIR, FFT, etc.
- The last part is for operation of the DES experiment platform including all functions tested and some DSP solutions apply on the platform .

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How to do the experiments?

- The source codes of all experiments are provided to students.
- Detailed steps of experiments provided to students as well.
- First, the students complete one experiment by manipulative guide.
- Then, the students will do some exercises which are followed the manipulative guide.

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How to do the experiments?

- We designed 12 experiments
 - more than 5 development and debug key skills are included in each experiment.
- In order to master these key skills, we handpick the exercises behind every experiment.
- Students will modify the original source code to complete each experiment.

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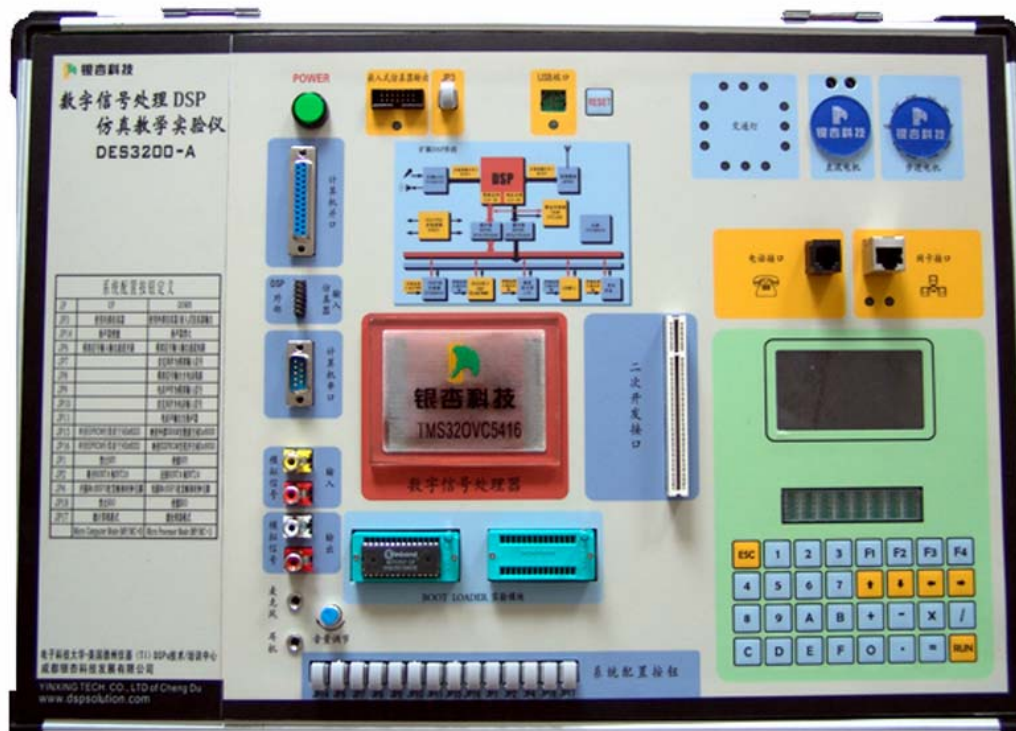
Award By Ministry of Education

- The second award by national education production in 2001.



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Appearance Picture of DES3200



- DES3200 is a product of general purpose DSP simulation and experiment by UESTC-TI DSP Technical & Training Centre and YinXing Tech. Ltd.

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Main Features of DES3200

- Supports TI's C2000, C5000, C6000, VC33 family DSPs through changing daughter board.
- Prepares a PCI-like interface for further development which can provide address, data, control, and other signal of DSP.
- Furnish one AIC for Audio interface including microphone and speaker.

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Main Features of DES3200

- Integrates many peripherals, such as LCD display, keypad, traffic light, numerator, UART asynchronous serial port, 10M/100M Ethernet card, USB interface, telephone jack, etc.
- Prepares more than 128k words SRAM or 4MB SDRAM and 32k words EEPROM for bootloader.

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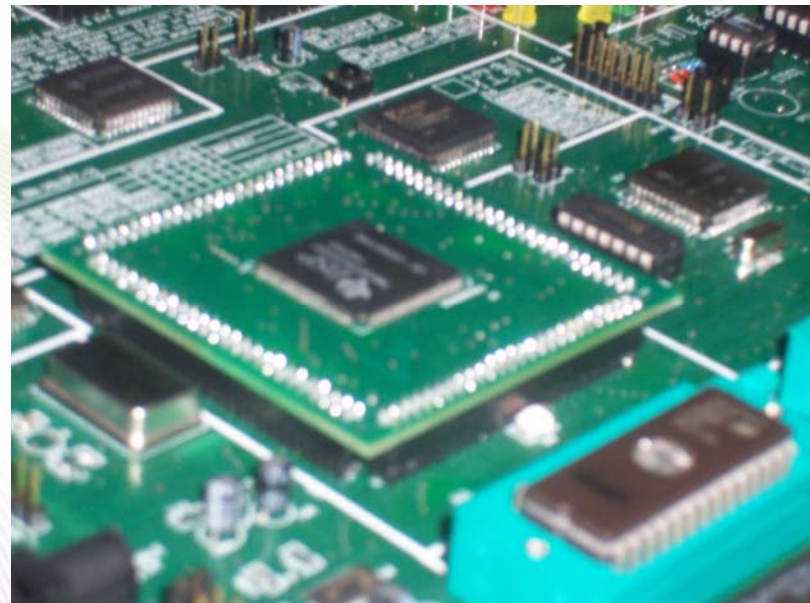
Bootloader module



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Study Different Types of DSP on Same System

- DSP daughter card includes:
 - TMS320C67/62XX
 - TMS320C55/54XX
 - TMS320C24/28XX
 - TMS320VC33



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Conclusion

- Our DSP technology course are made up of 3 parts: teaching, homework/project exercise and experiments.
- We start from a DSP Min-system, introduce DSP architecture, characteristics, development environment and implementation of digital signal processing algorithm.

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Conclusion

- Students can consolidate and improve their DSP application capability through homework and project exercises.
- We design systemic and abundant experiments based on our DES system.
- Students will have hardware and software training through experiments to master basic DSP development skills.

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DSP Education in UESTC

Thanks !

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