



# DSP FIRST: What Next?

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# Outline

- Review “*DSP First*”
- What’s missing from *DSP First*
- Look at real-time *DSP First* via VAB™
- VAB™ demos
- Conclusions

# *DSP First*

- 3 hour classroom, 3 hour lab
- Weekly MATLAB based labs
- Students experiment with digital signal processing (audio and image)
- Mostly DSP theory, not implementation
- Before **Circuits!**

# Advantages of *DSP First*

- Give EE's an early exposure to DSP
- Give non-EE's an exposure to DSP
- An intuition is built via processing real signals.
- Low lab costs
- Multimedia is attractive to students

# Topics in *DSP First*

- Sinusoidal signals
- Phasors
- Frequency content
- Frequency response
- Synthesizing sounds
- Sampling, aliasing and quantization
- FIR filtering
- IIR filtering
- z-transform analysis with polynomials

# Adopters of *DSP First*

- *Arizona State Univ.*
- *Calif. State Univ. - Sacramento*
- *California State-Long Beach*
- *Canada College*
- *Clark Atlanta Univ.*
- *Colorado School of Mines*
- *DePaul Univ. - Lincoln Park*
- *Devry Inst. of Tech.*
- *Diablo Valley College*
- *Duke Univ.*
- *Emory Univ.*
- *Florida Intl. Univ.*
- *George Mason Univ.*
- *Georgia Inst. of Tech.*
- *Indiana Univ. - Bloomington*
- *Kean College of New Jersey*
- *Lake Superior State Univ.*
- *North Carolina State Univ.*
- *Northern AZ Univ.*
- *Ohio State Univ.*
- *PA College of Tech.*
- *Penn State Univ. - Great Valley*

# Adopters of *DSP First*

- *Rose-Hulman Inst. of Tech.*
- *SanDiego State Univ.*
- *Santa Clara Univ.*
- *So. Illinois Univ. - Carbondale*
- *South Dakota State Univ.*
- *Stanford Univ.*
- *Stevens Inst. of Tech*
- *Tufts Univ.*
- *Univ. Cal Ext. - Santa Cruz*
- *Univ. of California - Berkeley*
- *Univ. of California - Irvine*
- *Univ. of Houston - Clearlake*
- *Univ. of Oklahoma*
- *Univ. of Southern California*
- *Univ. of Florida*
- *Univ. of Houston*
- *Univ. of Tennessee*
- *Univ. of Texas*
- *Univ. of Tulsa*
- *Valdosta State Univ.*
- *Vanderbilt Univ.*

# Missing From *DSP First*

$$y[n] = a_0 y[n-1] + b_0 x[n] + b_1 x[n-1]$$

That's great, but how do you *do* it?



# Real-time DSP



- Texas Instruments 'C31 DSK
- Pros:
  - *Real DSP*
  - *Inexpensive*
  - *"Real World"*
- Cons
  - *Long learning curve*
  - *Violates DSP First philosophy*



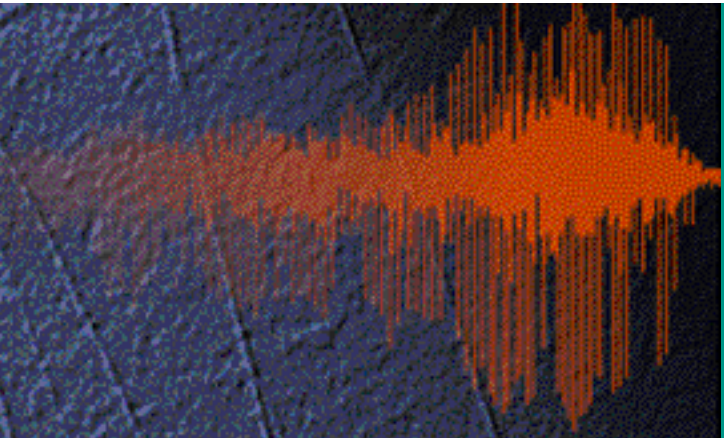
Wouldn't be nice if you could...

- Quickly show what sampled and reconstructed speech sounds like
- Plot the waveform in real-time
- See the spectrum too
- Throw in a sinewave

....without assembly programming?

# Or how about....

- Multiply by a sine
- Quantize
- Building an FIR filter
- Changing its coefficients on the fly





Or do some other neat stuff....

- Flanger
- FM synthesis
- PSK/FSM
- Image processing
- DTMF
- Fourier series

# Not Enough Time

- See VAB™ demos Thursday
- Pick up pre-release of VAB™ to demo yourself

# Which DSP?

- 'C24x EVM
- 'C3x DSK and others
- 'C6x EVM, DSK and others
- 'C54x planned
- With minimal changes

# DSP: It's not just for EE's any more

- Different types of students need different levels of abstraction
  - *Block Diagrams:* *Broad range of students*
  - *C:* *EE's, CmpE's, CS'es*
  - *asm:* *Who?*

# Real-time DSP Lab Setup



- 'C31 DSK
- Computer
- VAB™
- Optional
  - *Speakers/headphones/mikes*
  - *Signal generator/O'scope*
  - DSP First



# Conclusions

- DSP can be taught early in the curriculum
- Real-time DSP can add more excitement
- Real-time DSP can provide new insights
- More focus on application, less on implementation details
- Assembly programming isn't needed
- Come see the demos at the Thursday evening display