DSPDude

Re-programmable audio Digital Signal Processor

Valentina Chamorro & Yanni Coroneos
- daisy-chainable
- interchangeable filters via SD card
- high-quality 24bit, 192KHz, dual-channel output
- isolated communications over fiber-optic
Why Not Analog Filters?

- analog filters are not reconfigurable
  - All passives must be recalculated
- analog filters are big and expensive
  - Different circuit for every filter
- we can reasonably get higher order filters with an fpga
  - Just need faster clock and more FIR coefficients OR more slices
4th Order Analog Filter

- Good luck
What

Why

How

Demo

Timeline

Input Stage

- SPDIF/TOSLink
- AK4117 decodes SPDIF to i2s

Clock

Data

Encoded (BMC)

LRCK

BICK (64fs)

SDATA

23:MSB, 0:LSB

Lch Data

Rch Data
Serial & FSM's

- AK4117 and AK4396 have control registers
- Programmed with 16bit SPI
i2s & FIR
- Output new 24bit sample every LRCLK cycle
  - 100MHz/192KHz => 520 MAC’s
- i2s tx/rx converts signed pcm ⇔ i2s
Coefficient Generation

- MATLAB program generates coefficients
  - *filtertool*
- Stored on SDcard
  - *uses spi*
- Read and output to FIR

Filter Design Program such as MATLAB
VGA Visualization

- Settings controller for AK4396 sends volume data
- Visualize volume on VGA
Output Stage

- Outputs at sampling frequency
  - 192KHz target frequency
Generating Coefficients

- How to generate FIR coefficients in MATLAB
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<td>settings controller module</td>
<td>generate fir coefficients</td>
<td>interface amplifier and speakers with fpga</td>
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<td>serial controller module</td>
<td>codec outputs sound</td>
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Questions?