Digital Audio Processor

William Buttiger and Dimitri Podoliev
Project Overview

- Highly customizable digital audio system
- Provide pre-built effects packages with user-specifiable parameters
- Use audio “building blocks” with the packages to create unique effects
- Use a computer to configure the processor
Interconnect Architecture

- Asynchronous Interconnect
- Router provides most flexibility

- Reprogramming done by synchronized FSM.
- Control Bit controls a tristate buffer
<table>
<thead>
<tr>
<th>Module Name</th>
<th>Parameters</th>
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</thead>
<tbody>
<tr>
<td>Delay</td>
<td>Duration, Level, Feedback</td>
</tr>
<tr>
<td>Band Pass</td>
<td>Central Frequency, Width</td>
</tr>
<tr>
<td>Compressor</td>
<td>Threshold, Ratio, Attack time, Release Time</td>
</tr>
<tr>
<td>Expander</td>
<td>Threshold, Ratio, Attack time, Release Time</td>
</tr>
<tr>
<td>Mixer</td>
<td>-</td>
</tr>
<tr>
<td>Multiplier</td>
<td>Co-efficient</td>
</tr>
</tbody>
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……..More?
Theoretical Implementation of Filters
Signal Processing

Digital filters implementation:
- IIR (Infinite Impulse Response)
- FIR (Finite Impulse Response)

Design Path of an IIR filter:
- Bode plot
- Transfer Function
- Impulse Response
- Z-transform
- Difference equation
- Verilog implementation using modular blocks
Implementation of a single pole Low Pass Filter

- Transfer function: \( H(s) = \frac{1}{1 + \tau s} \)
- Difference equation: \( y[n] = a_0 x[n] + b_1 y[n-1] \)
- Implementation diagram:
- Other filters, such as:
  - High Pass
  - Band Pass
  - Band Reject
- Can be easily implemented using this building block
Design of a Simple Phaser

Block Diagram:
- Input (In)
- Addition (+)
- Two All Pass Filters
- Addition (+)
- Block B

Output (Out)
Routing of a Simple Phaser Filter
Questions?