Design and Implementation of a Digital Mixer with Digital Logic
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1. INTRODUCTION

- Digital mixer
- PLL based pass band filter
- Square wave input signals
- Spur
- Attenuated spur

D flip flop CD74HC74E, NOT gate CD74HC04E, XOR gate CD74HC86E, NOR gate CD74HC02E, AND gate CD74HC08E, PLL chip CD74HC4046AE

2. MIXER DESIGN

- Replace analogue signal by digital
- Multiplication is XOR
- Implement addition
- Implement phase shift - (using Dflip

Addition

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A+B</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>+2</td>
</tr>
</tbody>
</table>

- A and B are two level signal while A+B are three level signal.
- The first line is low level and is neither A NOR B, while the last one is high level and can be implemented as AND
- The output of the first line and last line will be input of RS trigger

3. SIMULATION

Figure 1: Functional diagram of the proposed mixer

Digital mixer:
- Use digital circuits (digital gates)
- Digital signals

Figure 2: Digital mixer with digital logic

4. IMPLEMENTATION AND MEASUREMENT

Figure 3: Simulation model using Simulink

Figure 4: Output power spectrum $f_1=1530$ Hz, $f_2=3060$ Hz, $f_{out}=765$ Hz.

Figure 5: Output power spectrum with and without filter $f_1=1530$ Hz, $f_2=3060$ Hz, $f_{out}=765$ Hz.

Figure 6: Output power spectrum $f_1=1530$ Hz, $f_2=3500$ Hz, $f_{out}=985$ Hz.

CONCLUSION

The digital mixer is realizable but has spurs, Careful filtering is needed

REFERENCES