Design and Implementation of a Digital Mixer with Digital Logic

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S31 DESIGN AND IMPLEMENTATION OF A DIGITAL MIXER WITH DIGITAL LOGIC

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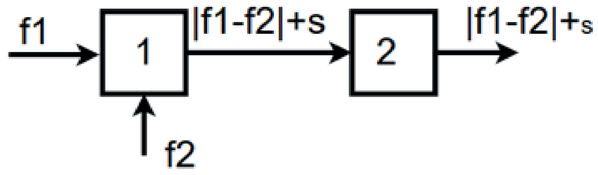
1.INTRODUCTION



1 : Digital mixer
2 : PLL based pass band filter
F1,f2 :square wave inputs signals
S: spurs
s: attenuated sp

Fig. 1 Functional diagram of the proposed mixer

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

2.MIXER DESIGN

. Analogue mixer can be expressed

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

.
Addition

A	B	A+B
-1	-1	-2
-1	1	0
1	-1	0
1	1	+2

- 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

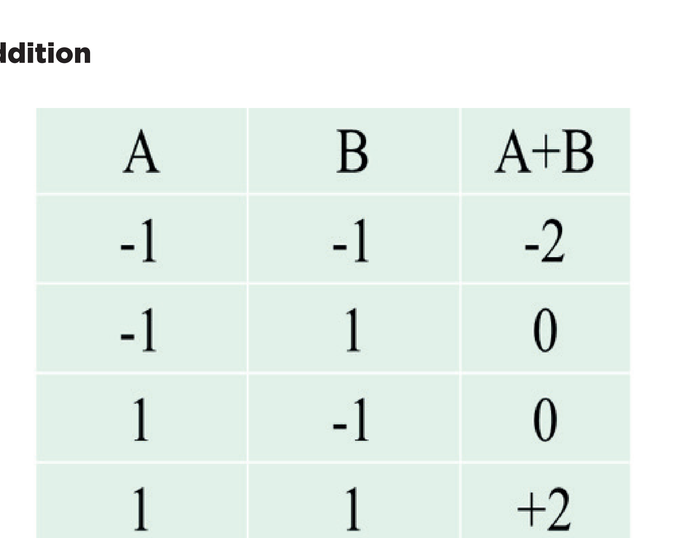


Figure 2. Digital mixer with digital logic

3.SIMULATION

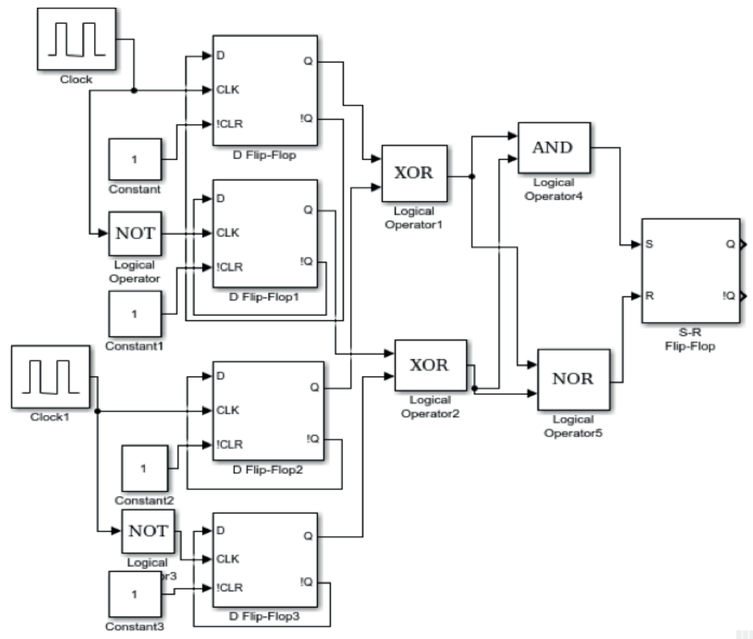


Figure 3: Simulation model using Simulink.

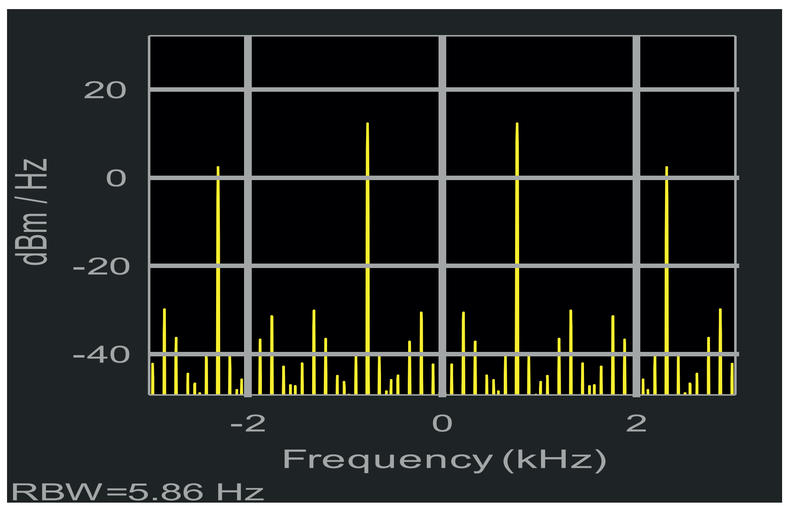


Figure 4. Output power spectrum f1=1530 Hz, f2=3060Hz, fout=765 Hz.

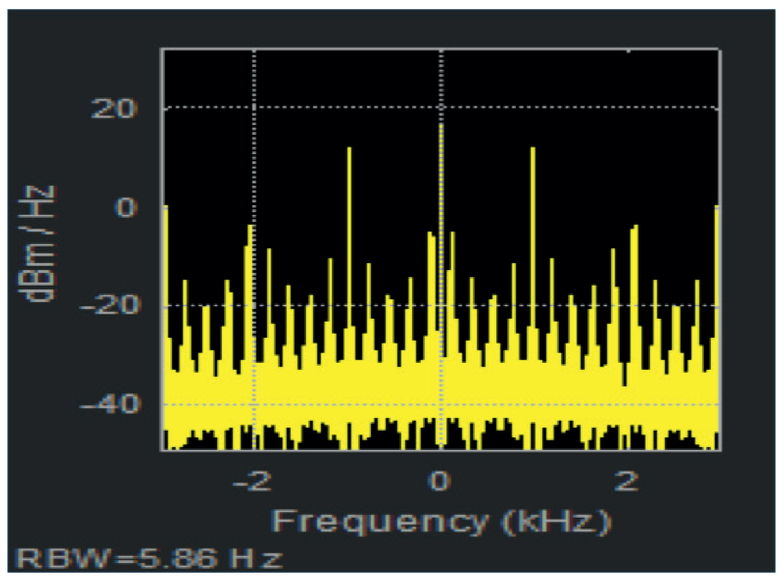


Figure 5. Output power spectrum f1=1530 Hz, f2=3500Hz, fout=985 Hz.

4. IMPLEMENTATION AND MEASUREMENT

D flip flop CD74HC74E, NOT gate CD74HC04E, XOR gate CD74HC86E, NOR gate CD74HC02E , AND gate CD74HC08EE4,
PLL chip CD74HC4046AE

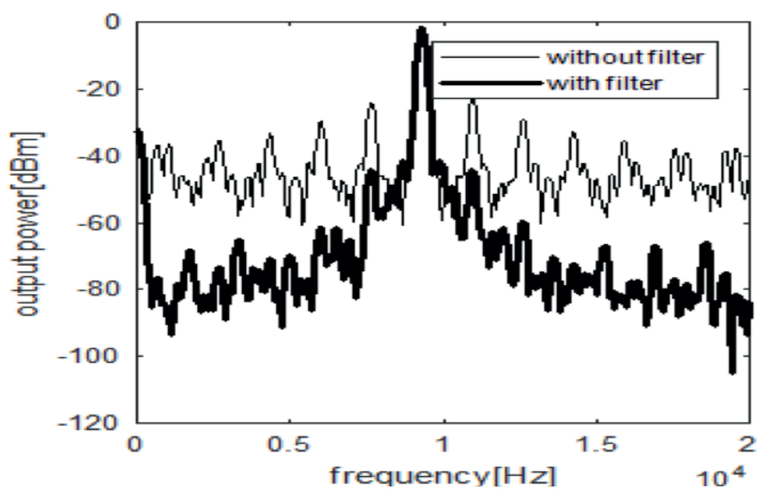


Figure 6. Output power spectrum with and without filter f1=56464 Hz, f2=37918 Hz, fout=9273 Hz.

CONCLUSION

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

REFERENCES

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