Efficient Amplification of Audio Waveforms

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Signal Decomposition

Signal decomposition is shown in Figure 1. It makes use of the property of the isosceles triangle. Two equal, fixed magnitude phasors are continuously rotated in order to track the time varying magnitude and phase of the desired modulation. Each of the two phasors is then up-converted and power amplified before being combined to recreate the modulated signal.

The output is a sequence of complex (magnitude and phase) time samples. The phasor fragmentation engine converts this sequence to two parallel sequences for the two phasors (carriers). The amplitude for the two equal magnitude phasors is:

$V_{PHASOR} = V_{MAX} / 2$

To the phase at each time sample, the phasor fragmentation engine adds and subtracts ϕ given by:

$\phi = \cos^{-1} (V / V_{MAX})$

Because the two phasors are of constant magnitude, low dynamic range (low compression point) amplifiers can be used. Further, highly efficient switch mode power amplifiers can be used, providing no-backoff amplification.

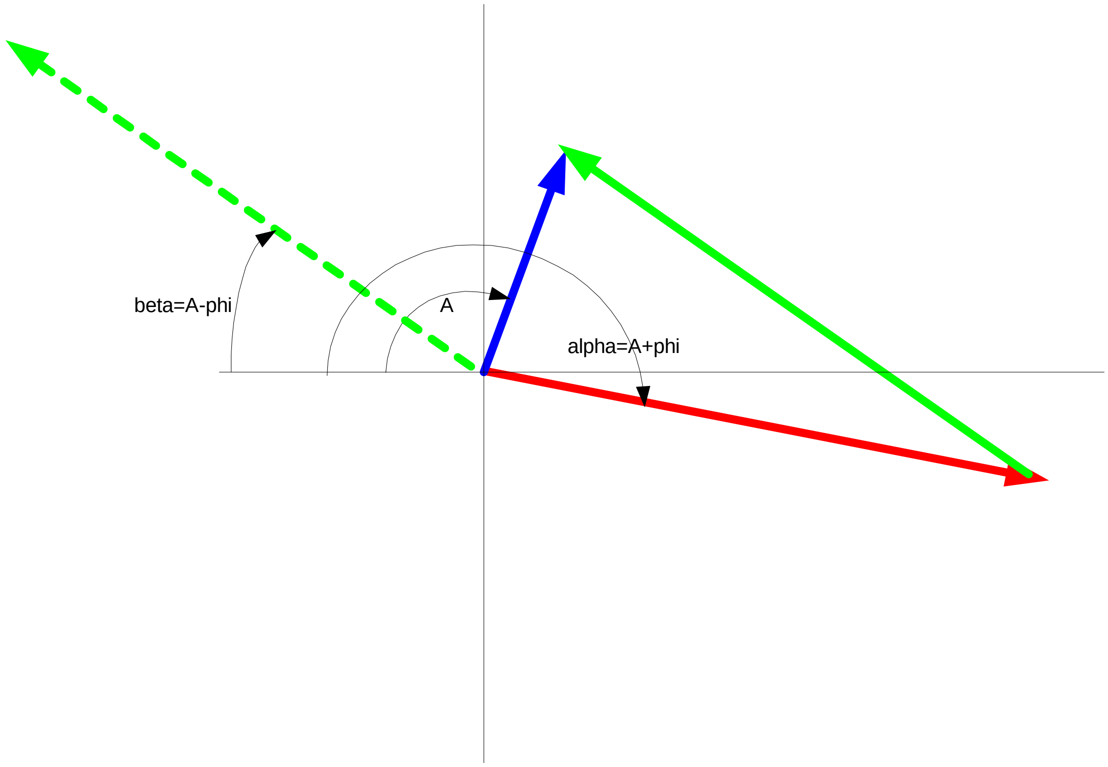

Figure 1. **Decomposition of the original signal (blue) into two equal magnitude signals (red and green) with different phase angles.**

Simulation Results

(refer to edrum.m)

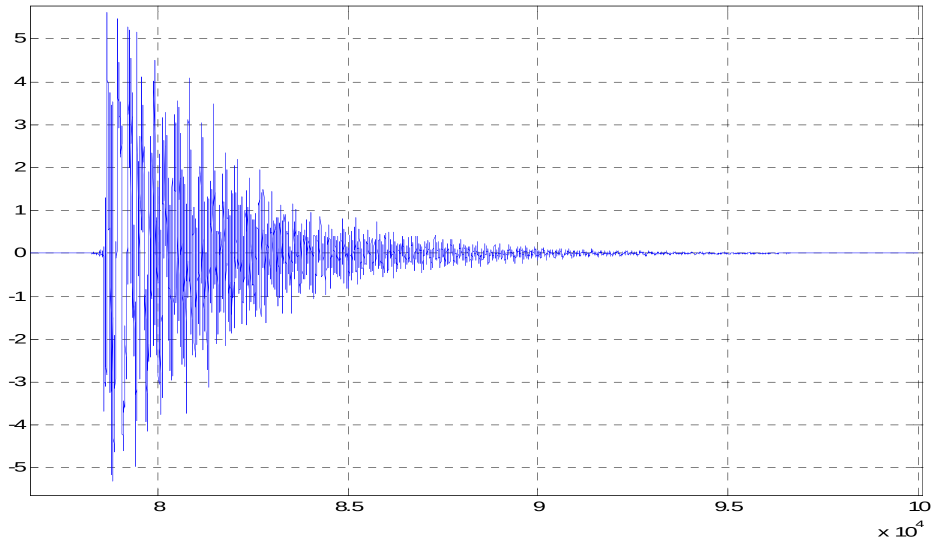

Figure 2. Snare signal

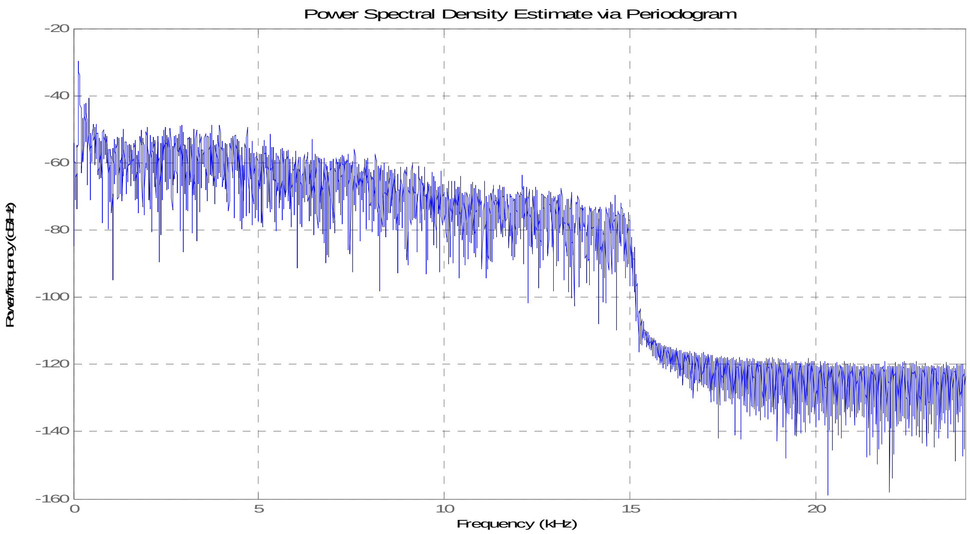

Figure 3. **Spectrum of snare signal.**

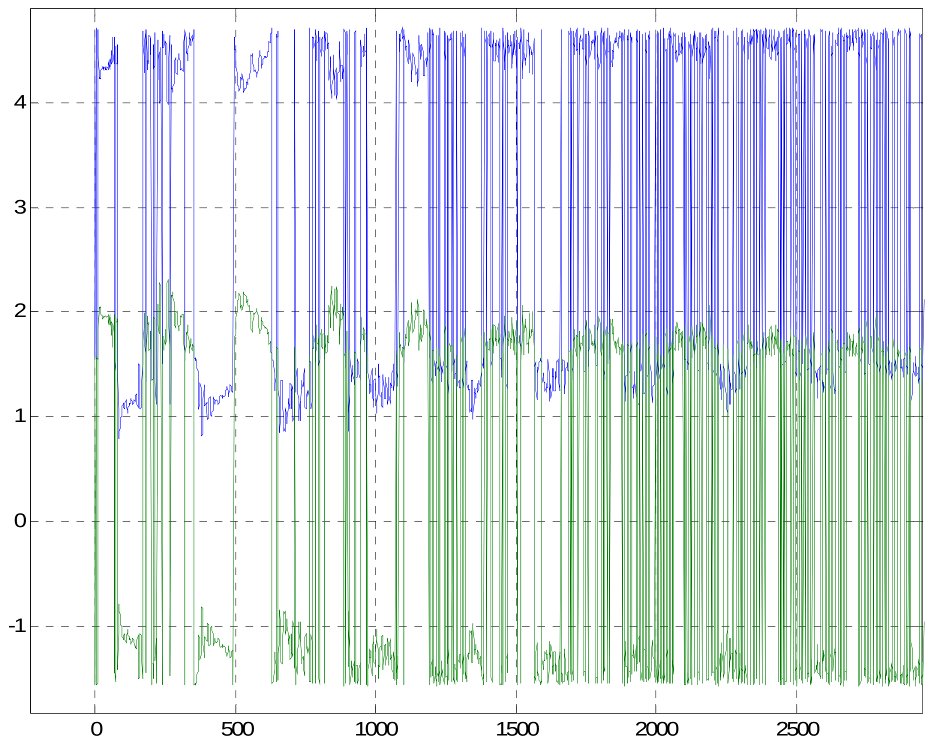

Figure 4 Two phases created by signal decomposition.

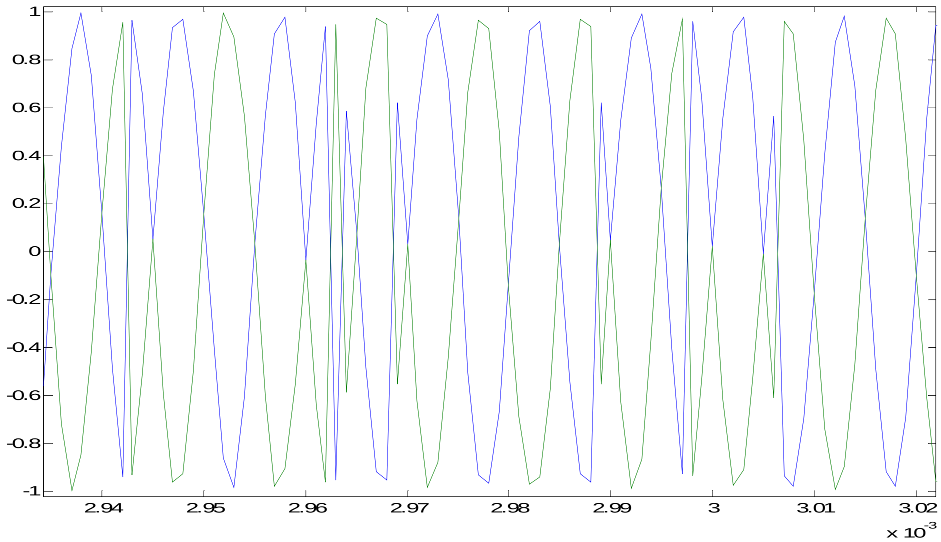

Figure 5. Two constant amplitude signals with two phases.

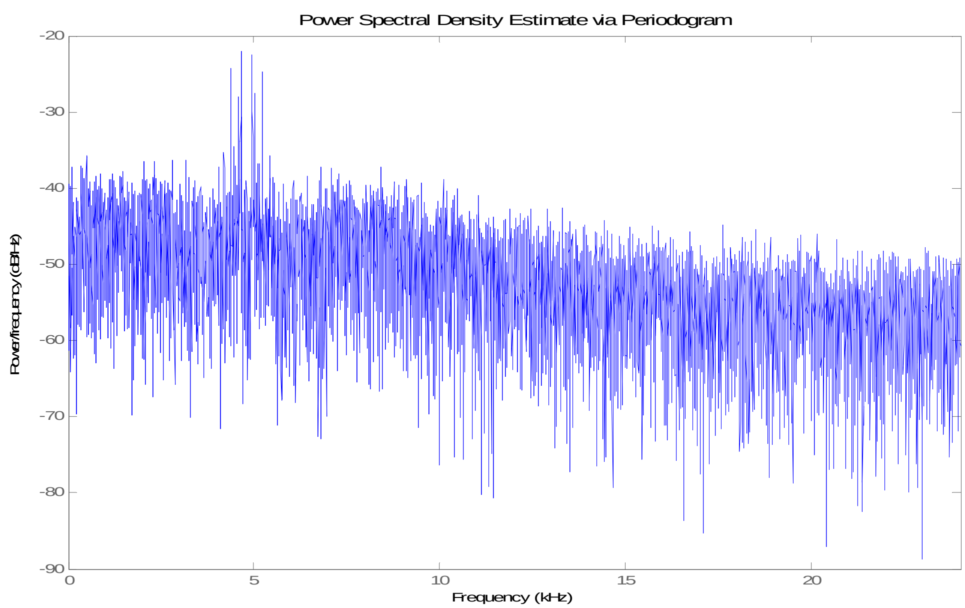

Figure 6. Spectrum of one of the sine waves.

It shows here that the spectrum of the decomposed signal is much wider than the original signal and means that spectral spreading is occurring.

Figure 7. Output signal showing 100KHz modulation.

The original content is present, but now I have to get rid of the 100KHz modulation…how to do it efficiently??
Try a chopping function….

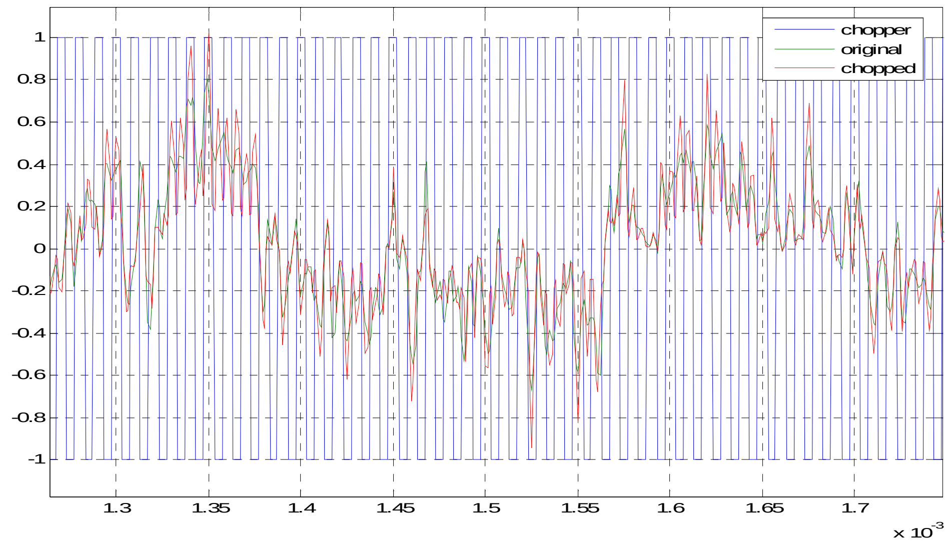

Figure 8. Original (green) and chopped signal (red) recovers the signal.

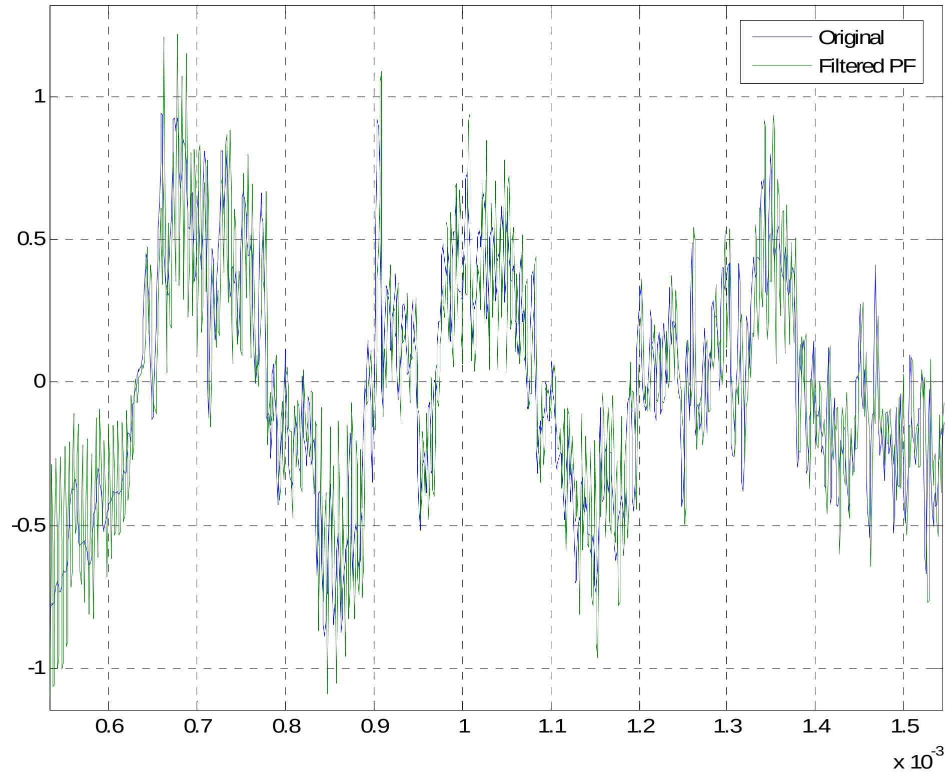

Figure 9. Final output after a benign LPF to remove chopping feedthrough.

Discussion

The output signal in Figure 7 has a significant amount of 100KHz signal energy, which I found has to be further chopped to remove.

At this time, this technique shows that this may be a problem, as the amplifier is now not a "switching" amplifier.

Ideas

If the summed output can be amplified by a chopping amplifier, then this may show promise. Not sure how to do this at this time.