

Re: "all pass" thought about (analogue) compression

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If you take a sine wave and run it through a circuit that does:

$$Y = X^{(17/19)}$$

the sine wave's RMS amplitude will be compressed towards about 0.98V RMS and there will be some distortion. The 3rd harmonic will be about 2.7%.

Assume that the sine wave we start with is 300Hz.

A phase shifter (all pass filter) can be made with a Q such that the 900Hz, 3rd harmonic is shifted by 180 degree relative to the 300Hz sinewave.

If we take this shifted signal and do another $X^{(17/19)}$ operation on it, the 3rd harmonic will only be about 0.2%

You don't need the phase shift to be exactly 180 degrees. Any non-zero phase shift and two steps of $(17/19)$ soft clipping will result in less harmonic content than one step of $(17/19)^2$ clipping would produce.

If more distortion can be lived with, a lower power such as $(11/13)$ could be used.

Since the band of interest is 300Hz to 3KHz, we don't have to worry about the harmonics of the frequencies above 1KHz. Those can be removed with a simple low pass filter. I haven't verified it yet but it seems to me that 3 stages of phase shifter and 4 clippers should be able to make a significant compression of amplitude but make less than 5% distortion on a sine wave.

The intermodulation distortion will not be made zero by this method. If the input has more than one frequency component, the distortion will be much higher.

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