Assume 2 non-linear, inverting gain stages Y en Z in cascade arrangement. Their Non linear transfer could be modelled like:

$Y = -\left(aX + bX^2 + cX^3\right)$ en $Z = -\left(dY + eY^2 + fY^3\right)$ [1], [2]

Now assume a = b = c = d = e = f, to simplify matters, and assume an input signal for Y:

$$Yin = \cos\ wt \qquad [3]$$

And play around with some goniometrical formula's:

$$\cos^2 wt = \frac{1}{2}\left(\cos 2wt + 1\right) \qquad [4]$$

and:

$$\cos^3 wt = \frac{1}{4}\left(\cos 3wt + \cos wt\right) \qquad [5]$$

Now the signal at the output of first stage Y becomes:

$$Yout = -\cos\ wt - \frac{1}{2}\cos\ 2wt - \frac{1}{2} - \frac{1}{4}\cos\ 3wt - \frac{1}{4}\cos\ wt \qquad [6]$$

$$Yout = -\frac{1}{2} - \frac{5}{4}\cos\ wt - \frac{1}{2}\cos\ 2wt - \frac{1}{4}\cos\ 3wt \qquad [7]$$

Watch the dc part, this is why the bias current of your SE amplifier shifts when driven hard….

This signal again will be amplified by Z. Again, for the sake of simplicity 2^e en higher order terms, and dc parts are not taken into account:

$$Zout = \frac{1}{2}\cos\ 2wt + \frac{1}{4}\cos\ 3wt + \frac{5}{4}\cos\ wt - \frac{1}{2}\bullet\frac{25}{16}\cos\ 2wt + \frac{1}{4}\bullet\frac{125}{64}\left(\cos\ 3wt + \cos\ wt\right) \qquad [8]$$

Which gives about:

$$Zout \frac{7}{4}\cos\ wt - \frac{1}{3}\cos\ 2wt + \frac{3}{4}\cos\ 3wt \qquad [9]$$

Now it becomes obvious that 2^{nd} harmonic becomes smaller, and 3^{rd} gets bigger, when comparing with [7]

Bottom line: When cascading non linear, inverting stages, the preceeding stage should be much more linear than the following.

Maybe I made some typo's. Maths never have been my strongest point. Maybe someone becomes triggered and can work this out with some more accuracy.

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