Analysis

The Relative gain of a single tuned amplifier is given as

$$\left[\frac{A_V}{A_{V(res)}}\right] = \frac{1}{1+j2\delta Q_{eff}}$$

A_V → voltage gain

$A_{V(res)}$ → Voltage gain resonant frequency

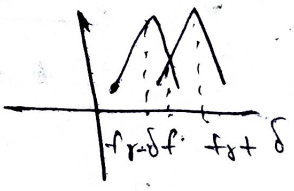
Q_{eff} → Effective Quality factor or Quality factor at resonant condition.

Assume, $X = 2\delta Q_{eff}$

$$\left[\frac{A_V}{A_{V(res)}}\right] = \frac{1}{1+jX}$$

Since one stage is tuned to frequency below fr i.e $f_r - \delta$ and other stage is tuned to a frequency above $f_r + \delta$

$$\left[\frac{A_V}{A_{V(res)}}\right]_1 = \frac{1}{1+j(X-1)}$$



$$\left[\frac{A_V}{A_{V(res)}}\right]_2 = \frac{1}{1+j(X+1)}$$

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The overall gain of two stages is the product of individual gains of the two stages

$$\left[\frac{A_V}{A_{V(res)}}\right]_{\text{stagger tuned pair}} = \left[\frac{A_V}{A_{V(res)}}\right]_1 * \left[\frac{A_V}{A_{V(res)}}\right]_2$$

$$= \frac{1}{1+j(x+1)} \times \frac{1}{1+j(x-1)}$$

$$= \frac{1}{(1+jx+j)} * \frac{1}{(1+jx-j)}$$

$$= \frac{1}{1+jx-j+jx+j^2x^2-j^2x+j-j^2x-j^2}$$

$$= \frac{1}{1+2jx-x^2+x-x+1}$$

$$= \frac{1}{2+2jx-x^2}$$

$$= \frac{1}{2x-x^2+j2x}$$

$$\left[\frac{A_V}{A_{V(res)}}\right]_{\text{stagger tuned pair}} = \frac{1}{\sqrt{(2-x^2)^2+(2x)^2}}$$

$$= \frac{1}{\sqrt{4+x^4-4x^2+4x^2}}$$

$$= \frac{1}{\sqrt{4+x^4}}$$

where $x = 2\delta Q_e$

$$= \frac{1}{\sqrt{4+(2\delta Q_e)^4}}$$

$$= \frac{1}{\sqrt{4+16\delta^4 Q_e^4}}$$

$$= \frac{1}{2\sqrt{1+4\delta^4 Q_e^4}}$$

This is relative gain of stagger tuned amplifier.

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