put *** inside

$$V_{in} = \left[\left[1+\frac{1}{sCR}\right]\left[1+\frac{1}{sCR}\right]-1\right]B - \left[1+\frac{1}{sCR}\right]V_{out}$$

$$V_{in} = \left[\left(1+\frac{1}{sCR}\right)\left(1+\frac{1}{sCR}\right)-1\right]\left(1+\frac{1}{sCR}\right)V_{out} - \left(1+\frac{1}{sCR}\right)V_{out}$$

$$V_{in} = \left[4+\frac{1}{s^2C^2R^2}+\frac{4}{sCR}-1\right]\left(1+\frac{1}{sCR}\right)V_{out} - \left(1+\frac{1}{sCR}\right)V_{out}$$

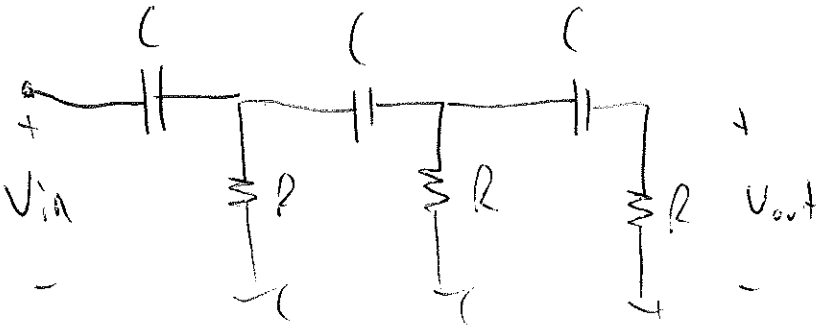
$$V_{in} = \left[\left(3+\frac{1}{s^2C^2R^2}+\frac{4}{sCR}\right)\left(1+\frac{1}{sCR}\right) - \left(1+\frac{1}{sCR}\right)\right]V_{out}$$

$$V_{in} = \left[3+\frac{7}{sCR}+\frac{5}{s^2C^2R^2}+\frac{1}{s^3C^3R^3}-1-\frac{1}{sCR}\right]V_{out}$$

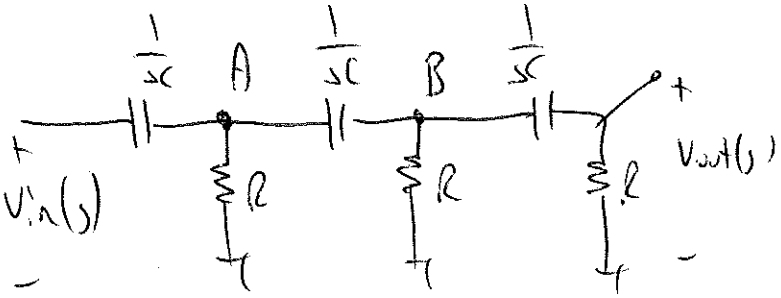
$$V_{in} = \left[1+\frac{6}{sCR}+\frac{5}{s^2C^2R^2}+\frac{1}{s^3C^3R^3}\right]V_{out}$$

$$V_{in} = \left[\frac{s^3C^3R^3+6s^2C^2R^2+5sCR+1}{s^3C^3R^3}\right]V_{out}$$

$$\frac{V_{out}}{V_{in}} = \frac{s^3C^3R^3}{s^3C^3R^3+6s^2C^2R^2+5sCR+1}$$




Laplace




$$\frac{V_{in}-A}{\frac{1}{sC}} = \frac{A}{R} + \frac{A-B}{\frac{1}{sC}}$$

$$\frac{A-B}{\frac{1}{sC}} = \frac{B}{R} + \frac{B-V_{out}}{\frac{1}{sC}}$$

* $sCV_{in} = \left[2sC + \frac{1}{R}\right]A - sCB$

$sCA = \left(2sC + \frac{1}{R}\right)B - sCV_{out}$

** $A = \left(2 + \frac{1}{sCR}\right)B - V_{out}$

$$\frac{B-V_{out}}{\frac{1}{sC}} = \frac{V_{out}}{R}$$

$BsC = \left[sC + \frac{1}{R}\right]V_{out}$

$B = \left[1 \| \frac{1}{sCR}\right]V_{out}$ ***

* and **

$$sCV_{in} = \left[2sC + \frac{1}{R}\right]\left\{\left[2 + \frac{1}{sCR}\right]B - V_{out}\right\} - sCB$$

$$sCV_{in} = \left(2sC + \frac{1}{R}\right)\left(2 + \frac{1}{sCR}\right)B - \left[2sC + \frac{1}{R}\right]V_{out} - sCB$$

$$V_{in} = \left[2 + \frac{1}{sCR}\right]\left(2 + \frac{1}{sCR}\right)B - \left(2 + \frac{1}{sCR}\right)V_{out} - B$$

out $s = j\omega$

$$H(j\omega) = \frac{V_{out}(j\omega)}{V_{in}(j\omega)} = \frac{-j\omega^3 C^3 R^3}{(1-\omega^2 6C^2R^2) + (5j\omega CR - j\omega^3 C^3 R^3)}$$

$\angle H(j\omega) = 180^\circ \Rightarrow$ for oscillation $\quad 1 - \omega^2 6C^2R^2 = 0 \quad \omega_0^2 = \frac{1}{6C^2R^2} \quad \omega_0 = \frac{1}{\sqrt{6}CR}$

$$f_0 = \frac{1}{2\pi\sqrt{6}CR}$$

Let's find $|H(j\omega)|_{\omega=\omega_0 = \frac{1}{\sqrt{6}CR}}$

$$|H(j\omega)| = \frac{\omega^3 C^3 R^3}{\sqrt{\left[(-\omega^2 6C^2R^2\right]^2 + \left[5\omega CR - \omega^3 C^3 R^3\right]^2}}$$

$$|H(j\omega)|_{\omega=\omega_0 = \frac{1}{\sqrt{6}CR}} = \frac{\frac{C^3R^3}{6\sqrt{6}C^3R^3}}{\sqrt{0 + \left[5\frac{1}{\sqrt{6}CR}CR - \left(\frac{1}{\sqrt{6}CR}\right)^3 C^3R^3\right]^2}}$$

$$= \frac{\frac{1}{6\sqrt{6}}}{\sqrt{\left[\frac{5}{\sqrt{6}} - \frac{1}{6\sqrt{6}}\right]^2}} = \frac{\frac{1}{6\sqrt{6}}}{\frac{29}{6\sqrt{6}}} = \frac{1}{29}$$