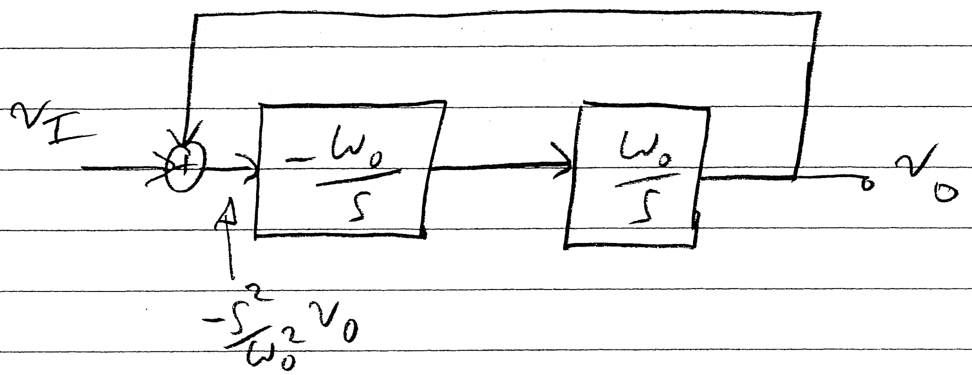
CONT-TIME 2 INTEGRATOR LOOP

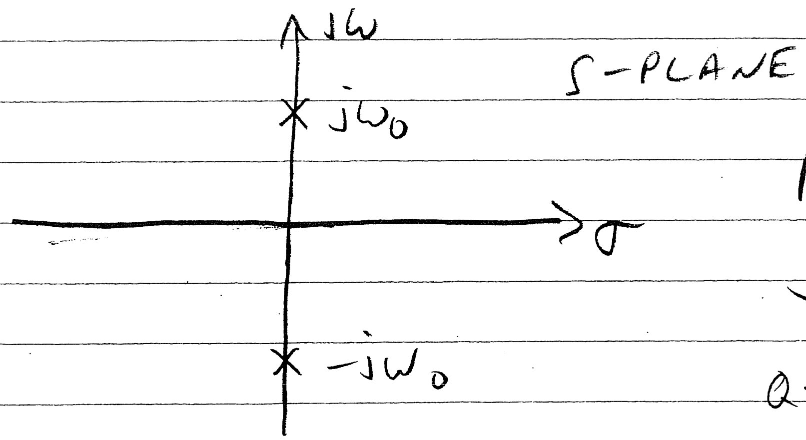


$$-\frac{s^2}{\omega_0^2} v_o = v_o + v_I$$

$$(s^2 + \omega_0^2) v_o = -\omega_0^2 v_I$$

$$\frac{v_o}{v_I} = \frac{-\omega_0^2}{s^2 + \omega_0^2}$$

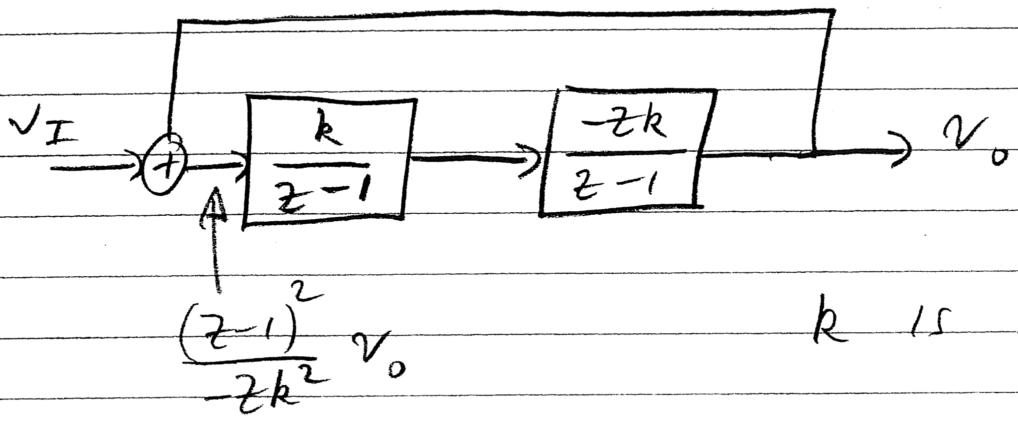
POLES AT $s^2 + \omega_0^2 = 0 \Rightarrow s = \pm j\omega_0$



POLES ON jw AXIS

$Q \to \infty$

DISCRETE-TIME 2 INTEGRATOR LOOP



k IS A CONSTANT

$$\frac{(z-1)^2}{-zk^2} v_o = v_o + v_I$$

$$(z-1)^2 v_o + zk^2 v_o = -zk^2 v_I$$

$$\left(z^2 + (k^2-2)z + 1\right) v_o = -zk^2 v_I$$

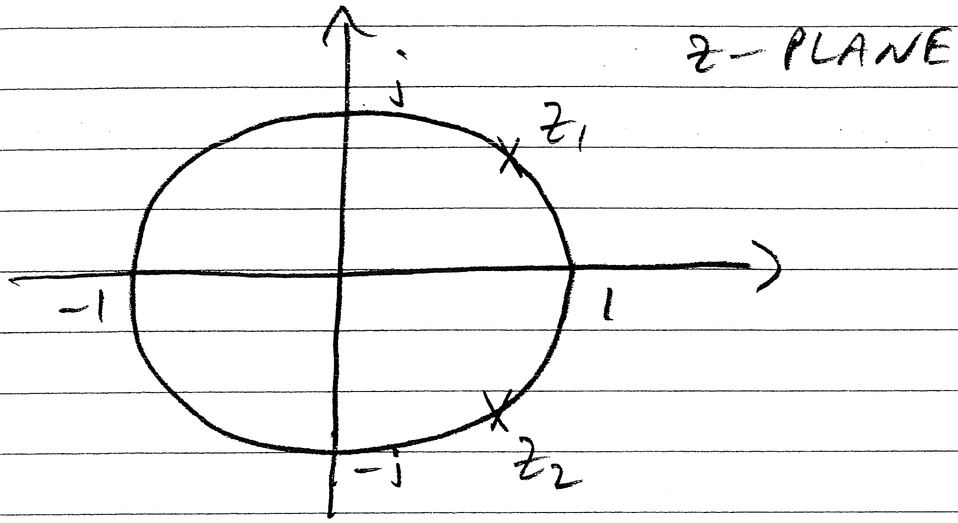
$$\frac{v_o}{v_I} = \frac{-zk^2}{z^2 + (k^2-2)z + 1}$$

POLES AT

$$z^2 + (k^2-2)z + 1 = 0$$

SOLVE FOR z_1, z_2 $\Rightarrow$ CAN SHOW

$$|z_1| = |z_2| = 1$$



z_1, z_2 ALWAY ON UNIT CIRCLE => k ADJUSTS WHERE ON CIRCLE

WHY CARE ?

IN CONT-TIME CASE, VARIATIONS IN ω_0 ONLY MOVE POLES ALONG $j\omega$ AXIS

IN DISCRETE-TIME CASE, VARIATIONS IN R ONLY MOVE POLE AROUND UNIT CIRCLE

IN BOTH CASE, THIS RESULTS IN LESS SENSITIVITY FOR HIGH Q FILTERS.