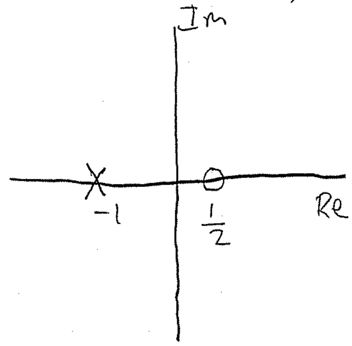
The inverse of an LTI system $H(s)$ is defined as a system that, when cascaded with $H(s)$, results in an overall transfer function of unity or, equivalently, an overall impulse response that is an impulse

(a) If $H_1(s)$ denotes the transfer function of an inverse system for $H(s)$, determine the general algebraic relationship between $H(s)$ and $H_1(s)$.

(b) Shown to the right is the pole-zero plot for a causal, stable system $H(s)$. Determine the pole-zero plot for the associated inverse system.

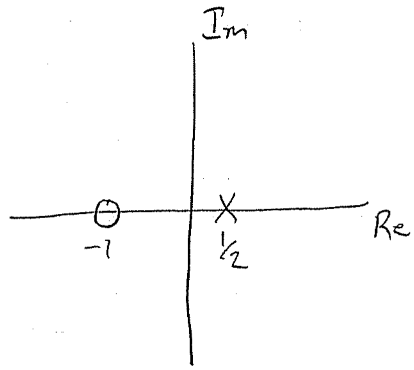


(a) Since we require $H(s)\,H_1(s) = \underline{1}$

this means that $\boxed{H_1(s) = \frac{1}{H(s)}}$

(b) $H(s)$ is represented as

$$H(s) = \frac{(s-z_1)(s-z_2)\cdots(s-z_M)}{(s-p_1)(s-p_2)\cdots(s-p_N)}$$



and

$$H_1(s) = \frac{1}{H(s)} = \frac{(s-p_1)(s-p_2)\cdots(s-p_N)}{(s-z_1)(s-z_2)\cdots(s-z_M)}$$

so the poles of $H(s)$ become the zeros of $H_1(s)$

and the zeros of $H(s)$ become the poles of $H_1(s)$