$E[s] = (1 - \|S\|_f^2) \cdot \|V_i\|_f^2 \Rightarrow \|S\|_f$ bounded by 1

$\Rightarrow$ passive $S(s)$ are bounded real

by definition $S(s)$ is bounded real if

1) $S(s)$ has $[S]$ real in $s > 0$ (real elements)

2) $S(s)$ is analytic in $s > 0$ (also stability)

3) $1_n - S^{*T}(s) \cdot S(s)$ is positive semidef in $s \geq 0$

if rational 1) real coefficients

2) $\rightarrow$ stable $\rightarrow$ no poles in $s > 0$

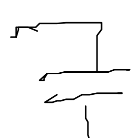
3) $\rightarrow$ no poles on $j\omega$ axis $\rightarrow L^2 \rightarrow L^2$ fn

Eg: $2v^i = v + i, \quad 2v^r = v - i$

$2V^i(s) = V(s) + I(s), \quad 2V^r(s) = V(s) - I(s)$

capacitor: $I(s) = C \cdot s \cdot V(s)$

$2V^i(s) = (1 + Cs)\, V(s), \quad 2V^r(s) = (1 - Cs) \cdot V$

$\frac{2V^r}{2V^i} = S(s) = \frac{1 - Cs}{1 + Cs} \Rightarrow$  C