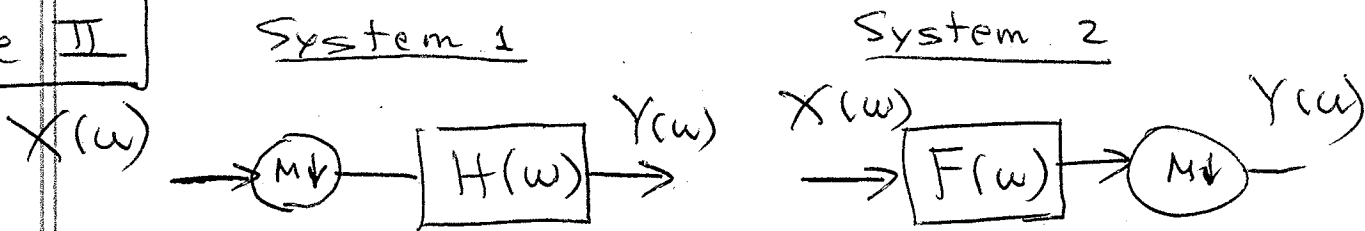


## Noble II



System 1: 
$$Y(\omega) = \left( \frac{1}{M} \sum_{k=0}^{M-1} X\left(\frac{\omega - k2\pi}{M}\right) \right) H(\omega)$$

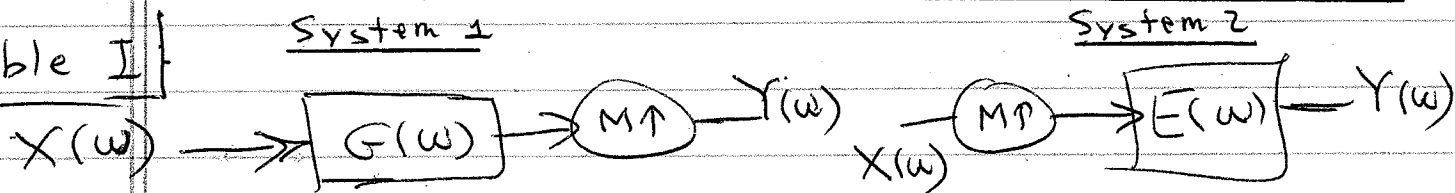
System 2: 
$$Y(\omega) = \frac{1}{M} \sum_{k=0}^{M-1} X\left(\frac{\omega - k2\pi}{M}\right) F\left(\frac{\omega - k2\pi}{M}\right)$$

If  $F(\omega) = H(M\omega)$ , then

$$\begin{aligned} F\left(\frac{\omega - k2\pi}{M}\right) &= H\left[M\left(\frac{\omega - k2\pi}{M}\right)\right] = H(\omega - k2\pi) \\ &= H(\omega) \quad (\text{DTFT periodic } 2\pi) \end{aligned}$$

Thus, if  $F(\omega) = H(M\omega)$  the two systems have the same I/O

## Noble I



System 1: 
$$Y(\omega) = G(M\omega) X(M\omega)$$

System 2: 
$$Y(\omega) = E(\omega) X(M\omega)$$

Thus, if  $E(\omega) = G(M\omega)$ , the systems have the same I/O relationship