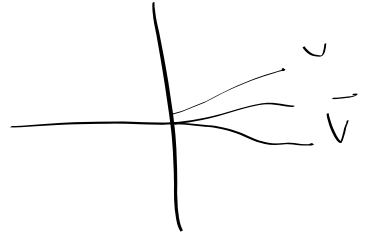


$$U = e^{\frac{2\pi i}{N}}$$

$$X_m(k)$$



$$X_{hM}[k] = 2X_m[k] - X_m[k-1]$$

$$f = \angle X_{h(m+1)}[k] - \angle X_{h(m)}[k] - X_m[k+1]$$

$$X_{h(m+1)}[k] = 2X_m[k]U^k - X_m[k-1]U^{k-1} - X_m[k+1]U^{k+1}$$

U

W

UV

$$f = \angle \left(\frac{2U^k X[k] - U^{k+1} X[k+1] - U^{k-1} X[k-1]}{2X[k] - X[k-1] - X[k+1]} \right)$$