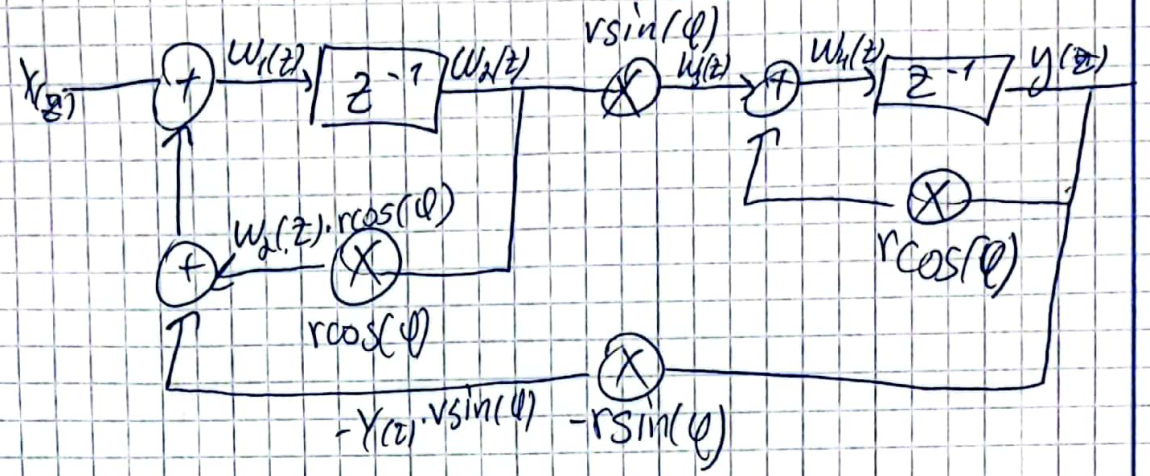
Gold and Rader → recursive part: $\left\{H(z) = \frac{N(z)}{1 - 2re(z_p)z^{-1} + (re^2 + im^2)z^{-2}}\right\}$



$$\begin{cases} (1) & Y(z) = W_4(z)\cdot z^{-1} \\ (2) & W_4(z) = W_3(z) + Y(z)\cdot r\cos(\varphi) \\ (3) & W_3(z) = W_2(z)\cdot r\sin(\varphi) \\ (4) & W_2(z) = W_1(z)\cdot z^{-1} \\ (5) & W_1(z) = W_2(z)\cdot r\cos(\varphi) - Y(z)\cdot r\sin(\varphi) + X(z) \end{cases}$$

(5) → (4): $W_2(z) = \left(W_2(z)\,r\cos(\varphi) - Y(z)\cdot r\sin(\varphi) + X(z)\right)z^{-1}$

$$W_2(z)\left\{1 - r\cos(\varphi)z^{-1}\right\} = \left(X(z) - Y(z)\,r\sin(\varphi)\right)z^{-1}$$

$$W_2(z) = \frac{X(z) - Y(z)\,r\sin(\varphi)}{1 - r\cos(\varphi)z^{-1}}\cdot z^{-1}$$

$W_2(z) \rightarrow (3)$:

$$W_3(z) = \frac{X(z) - Y(z)\,r\sin(\varphi)}{1 - r\cos(\varphi)z^{-1}}\cdot r\sin(\varphi)z^{-1}$$

$$W_3(z) = \frac{X(z)\,r\sin(\varphi)z^{-1}}{1 - r\cos(\varphi)z^{-1}} - \frac{Y(z)\,r^2\sin^2(\varphi)z^{-1}}{1 - r\cos(\varphi)z^{-1}}$$

$W_3(z) \rightarrow (2)$:

$$W_4(z) = \frac{X(z)\,r\sin(\varphi)z^{-1}}{1 - r\cos(\varphi)z^{-1}} - \frac{Y(z)\,r^2\sin^2(\varphi)z^{-1}}{1 - r\cos(\varphi)z^{-1}} + Y(z)\,r\cos(\varphi)$$

$W_4(z) \rightarrow (1)$:

$$Y(z) = \frac{X(z)\cdot r\sin(\varphi)z^{-2}}{1 - r\cos(\varphi)z^{-1}} - \frac{Y(z)\,r^2\sin^2(\varphi)z^{-2}}{1 - r\cos(\varphi)z^{-1}} + Y(z)\,r\cos(\varphi)z^{-1}$$

$$\dots \Rightarrow Y(z) + \frac{Y(z)r^2\sin^2(\varphi)}{1-r\cos(\varphi)z^{-1}}z^{-2} - Y(z)r\cos(\varphi)z^{-1} = \frac{X(z)r\sin(\varphi)z^{-2}}{1-r\cos(\varphi)z^{-1}}$$

$$Y(z)\left\{1 - r\cos(\varphi)z^{-1} + \frac{r^2\sin^2(\varphi)}{1-r\cos(\varphi)z^{-1}}z^{-2}\right\} = X(z)\left\{\frac{r\sin(\varphi)z^{-2}}{1-r\cos(\varphi)z^{-1}}\right\}$$

$$Y(z)\left\{\frac{1 - r\cos(\varphi)z^{-1} - r\cos(\varphi)z^{-1} + r^2\cos^2(\varphi)z^{-2} + r^2\sin^2(\varphi)z^{-2}}{1-r\cos(\varphi)z^{-1}}\right\} = X(z)\left\{\frac{r\sin(\varphi)z^{-2}}{1-r\cos(\varphi)z^{-1}}\right\}$$

$$= Y(z)\left\{\frac{1 - 2r\cos(\varphi)z^{-1} + r^2z^{-2}}{1-r\cos(\varphi)z^{-1}}\right\} = X(z)\left\{\frac{r\sin(\varphi)z^{-2}}{1-r\cos(\varphi)z^{-1}}\right\}$$

$$\Rightarrow \frac{Y(z)}{X(z)} = \frac{r\sin(\varphi)z^{-2}}{1 - 2r\cos(\varphi)z^{-1} + r^2z^{-2}}$$

let
$$\begin{cases} r\cos(\varphi) = Re\{z_0\} \\ r^2 = Re(z_0)^2 + Im(z_0)^2 \\ r\sin(\varphi)z^{-2} = N(z) \end{cases}$$

$$\Rightarrow H(z) = \frac{N(z)}{1 - 2Re(z_0)z^{-1} + \{Re(z_0)^2 + Im(z_0)^2\}z^{-2}}$$