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→ Signals PS-9:

2) ARMA and AR Models:

1) $x[n] = v[n] + 0.4v[n-1] + 0.2v[n-2] + 1.6x[n-1] - 0.81x[n-2]$

ARMA(N,M) → $v[n] = \frac{1}{b_0} x[n] + \dots \frac{a_M}{b_0} x[n-M] - \frac{b_1}{b_0} v[n-1] \dots - \frac{b_N}{b_0} v[n-N]$

→ so **ARMA(2,2)**, $p=2$, $q=2$

2) both current and pas vals

⇒ **innovations filter**

3) $v[n] = x[n] - 0.4v[n-1] - 0.2v[n-2] - 1.6x[n-1] + 0.81x[n-2]$

$v[n] = x[n] - 0.4v[n-1] - 0.2v[n-2] - 1.6x[n-1] + 0.81x[n-2]$

4) $x(z) = V(z) + 0.4z^{-1}V(z) + 0.2z^{-2}V(z) + 1.6z^{-1}X(z) - 0.81z^{-2}X(z)$

$= V(z)(1 + 0.4z^{-1} + 0.2z^{-2}) + X(z)(1.6z^{-1} - 0.81z^{-2})$

$H(z) = \frac{X(z)}{V(z)}$

$\frac{X(z)(1 - 1.6z^{-1} + 0.81z^{-2})}{V(z)} = \frac{V(z)(1 + 0.4z^{-1} + 0.2z^{-2})}{V(z)}$

$1 - 1.6z^{-1} + 0.81z^{-2}) \qquad 1 - 1.6z^{-1} + 0.81z^{-2})$

$H(z) = \frac{1 + 0.4z^{-1} + 0.2z^{-2}}{1 - 1.6z^{-1} + 0.81z^{-2}}$

5) $H(z) = \frac{1 + 0.4z^{-1} + 0.2z^{-2}}{1 - 1.6z^{-1} + 0.81z^{-2}}$ } $S_x(w) = |H(e^{jw})|^2 \cdot S_v(w)$

$\sigma_v^2 = 2$, $S_v(w) = 2$

$|H(e^{jw})^2| = |CH(z)|^2 |_{z=e^{jw}}$

$S_x(w) = |CH(z)|^2 |_{z=e^{jw}} \cdot 2$

$= 2|H(e^{jw})|^2$, where $H(z)$