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Electrónica Geral

2020/2021 – 1º Semestre

MEFT, MEAer

Problema

Filtros Digitais Adaptativos

Derivar as expressões do algoritmo LMS para os coeficientes do filtro digital adaptativo em modo de identificação com entrada x_k, saída $\hat{e}_k$, e função de sistema dada por:

$$T(z) = \hat{a}_0 + \sum_{i=1}^{2} \frac{1 + \hat{a}_{i1} z^{-1} + \hat{a}_{i2} z^{-2}}{1 + \hat{b}_{i1} z^{-1} + \hat{b}_{i2} z^{-2}}$$

Prob. 8.2 GG8

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$$T(z) = \hat{a}_0 + \frac{1+\hat{a}_{11}z^{-1}+\hat{a}_{12}z^{-2}}{1+\hat{b}_{11}z^{-1}+\hat{b}_{12}z^{-2}} + \frac{1+\hat{a}_{21}z^{-1}+\hat{a}_{22}z^{-2}}{1+\hat{b}_{21}z^{-1}+\hat{b}_{22}z^{-2}}$$

$$= \hat{a}_0 + S_1(z) + S_2(z)$$

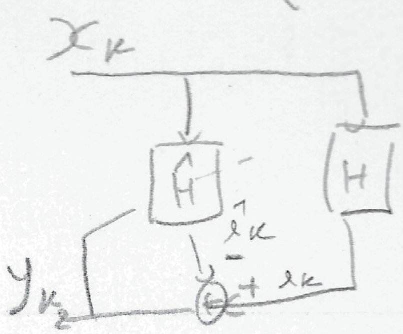
$$y_k^2 = (\underbrace{\ell_k - \hat{\ell}_k}_{y_k})^2$$

(1) LMS: $\boxed{\hat{c}_i(k+1) = \hat{c}_i(k) + \overbrace{2\mu\, y_k\, \alpha_{\hat{c}_i}(k)}^{-\mu \frac{\partial y_k^2}{\partial \hat{c}_i}}}$, $\alpha_{\hat{c}_i}(k) = \frac{\partial \hat{e}_k}{\partial \hat{c}_i}$

$$\alpha_{\hat{c}_i}(z) = \frac{\partial \hat{e}(z)}{\partial \hat{c}_i} = X(z)\,\frac{\partial T(z)}{\partial \hat{c}_i}$$

$$\boxed{\alpha_{\hat{a}_0}(z) = X(z)} \qquad \boxed{\alpha_{\hat{a}_{ij}}(z) = X(z)\,\frac{z^{-j}}{1+\hat{b}_{i1}z^{-1}+\hat{b}_{i2}z^{-2}}}$$

$$\alpha_{\hat{b}_{ij}}(z) = -X(z)\,S_i(z)\,\frac{z^{-j}}{1+\hat{b}_{i1}z^{-1}+\hat{b}_{i2}z^{-2}}$$



$y_k = \ell_k - \hat{\ell}_k$
$\hat{E}(z) = \hat{H}(z)\,X(z)$

$$\hat{c}_i(k+1) = \hat{c}_i(k) - \mu\frac{\partial y_k^2}{\partial \hat{c}_i} =$$

$$= \hat{c}_i(k) - 2\mu\, y_k \frac{\partial y_k}{\partial \hat{c}_i} =$$

$$= \hat{c}_i(k) + 2\mu\, y_k \underbrace{\frac{\partial \hat{\ell}_k}{\partial \hat{c}_i}}_{\alpha_1(k)} \quad (1)$$