

## HOMEWORK #2

Due Friday, October 16, 2009 (5:00 p.m.)

**Reading:** Chapters 2 (2.8–2.10) and 4 (4.1–4.7)

### Problems:

1. Chapter 2: Problem 2
2. Chapter 2: Problem 5
3. Chapter 2: Problem 6
4. Chapter 2: Problem 10
5. Chapter 2: Problem 12
6. Suppose that the signal  $x(n)$  has the following autocorrelation function:

$$\phi_{xx}(m) = \sigma_x^2 a^{|m|}, \quad m = 0, 1, \dots$$

where  $\sigma_x^2$  and  $a$  are fixed parameters.

- (a) Derive the optimal  $N = 1$  and  $N = 2$  coefficient filters for predicting  $x(n)$  based on  $N$  previous samples.
- (b) Does the result for  $N = 2$  violate your intuition? What property of the process causes this result? What would you expect the result to be for  $N = 3$ ?
- (c) Suppose instead that  $x(n)$  has the power spectral density function

$$\Phi_{xx}(z) = \frac{\sigma_x^2}{A(z) A(z^{-1})}$$

where

$$A(z) = 1 - \sum_{k=1}^N a_k z^{-k}$$

and the parameters  $\{a_k\}$  are fixed. Find the optimal  $N$ -length filter for predicting  $x(n)$  from past samples.