PCE6205\_Final Exam

1. Suppose a car moved for 10 seconds. There are two sensors, the distance gauge and the speed gauge, by which the traveling distance may be estimated. The distance gauge indicates 1000m whose resolution is 1m. The speed gauge indicates 99m/sec whose resolution is 10m/sec.
   1. Assume the output of two gauges are uniformly distributed random variables,

find the variances of each sensors, i.e., the variances of the distance and speed gauge output.

* 1. find the minimum mean square estimation of the distance

1. Given a dynamic discrete system as

where all parameters are scalars.

* 1. Draw the block diagram for the system.
  2. What are the inputs of the system?
  3. Draw a block diagram of a computer model for Kalman filter
  4. In the computer model, what is the input and output?
  5. If , with the assumption calculate

Where

,

* 1. Let us assume , calculate

1. Consider the measurement is the sum of the random variables

The measured data are .

define the MV estimator ,

* 1. Using a batch type procedure find
  2. Using a recursive type procedure find

1. Consider the following signal on

Find the minimum mean-square approximation to the by the orthonormal basis:

(Hint. The Fourier series is the min mean square approximation of )

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1. Consider the following measurement equation

whose the singular value decomposition is

* 1. Let , calculate y
  2. Find the coefficients of a linear combination where
  3. Which state or combination of states do you expect to be most observable? Explain your answer.
  4. Which state or combination of states do you expect to be least observable?

Explain your answer.

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* 1. Draw the block diagram for the system.
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  4. In the computer model, what is the input and output?

2.5 If , with the assumption calculate

Where

,

2.6 Let us assume , calculate

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The measured data are .

define the MV estimator ,

* 1. Using a batch type procedure find
  2. Using a recursive type procedure find

1. Using the orthogonal projection lemma, derive the vector which minimizes the performance index

and if , if is restricted to lie in the subspace spanned by the vectors

i.e.,

- The End -

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1. The joint probability is
   1. Find the marginal probability of
   2. Find the marginal probability of
   3. Is random variables independent or dependent? Justify your answer.
   4. Find the expectation of
   5. Find covariance of
2. Given

Where their probability density function are

Find the probability density of

1. You may measure the voltage of a resister. There are two sensors to measure it.

So that

Now the measured data are

* 1. Find the sample mean and same variance of the measurement
  2. Find the sample mean and sample variance of the measurement of
  3. Find the MV estimator of

1. Given a dynamic discrete system as

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* 1. Draw the block diagram for the system.
  2. What are the inputs of the system?
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  4. In the computer model, what is the input and output?

3.5 If , with the assumption calculate

where

,

3.6 Let us assume , calculate

(Hint: input is a deterministic so it may be a bias)