Assignment 14

Donal Loitam - AI21BTECH11009

June 14, 2022

Papoulis chap 9 Exercise 9.51

TABLE OF CONTENTS

Problem

9-51 Show that if $R[m] = E\{x[n+m]x[n]\}$, then

$$R[0]R[2] > 2R^2[1] - R^2[0] \tag{1}$$

Solution

We shall show that

$$2\frac{R^2[1]}{R[0]} - R[0] \le R[2] \le R[0] \qquad (2)$$

The covariance matrix of the RVs $x[n]$, $x[n+1]$, and $x[n+2]$ is non-negative

$$\begin{bmatrix} R[0] & R[1] & R[2] \\ R[1] & R[0] & R[1] \\ R[2] & R[1] & R[0] \end{bmatrix} \ge 0$$

$$\implies R[0]R^2[2] - 2R^2[1]R[2] - R^3[0] + 2R[0]R^2[1] \le 0 \qquad (3)$$

The above is quadratic in R[2] with roots $R[0]$ an $-R[0] + 2R^2[1]/R[0]$ since it is non positive, R[2] must be between the roots as in

CODES

Python

Download python code from - Python

Beamer

Download Beamer code from - Beamer