Assignment-9 (Papoulis chap 6 Ex 6.10)

Asli

IIT Hyderabad

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Abstract

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This document contains the solution to Papoulis chap 6 Ex 6.10

Question

x and y are uniformly distributed on the triangular region $0 \leq x - y \leq x + y \leq 2$ Find the p.d.f. of $x + y$ and $x - y$

Solution

Solution-1

$$Z = X + Y \tag{1}$$

$$F_Z(z) = \int_0^{\frac{z}{2}} \int_x^{2-x} f_{XY}(x,y)dx \tag{2}$$

$$= \frac{z^2}{4}, 0 < z < 2 \tag{3}$$

$$f_Z(z) = \frac{z}{2}, 0 < z < 2 \tag{4}$$

Solution

Solution-2

$$w = X - Y \tag{5}$$

$$F_W(w) = \frac{1}{2}(2+w)(1+\frac{w}{2}) \tag{6}$$

$$= \left(1+\frac{w}{2}\right)^2 \tag{7}$$

$$F_W(w) = \begin{cases} 1+\frac{w}{2}, -2 < w < 0 \\ 0, \text{otherwise} \end{cases} \tag{8}$$