

# Characteristics of Multiple Random Variables

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Based on  
Probability, Random Variables and Random Signal Principles,  
P.Z. Peebles, Jr. and B. Shi

# Outline

## 1 Simulation of Multiple Random Variables

# Example Problem

$N$  Gaussian random variables

## Definition

two statistically independent Gaussian random variables  $Y_1, Y_2$  each with zero mean and unit variance, can be generated by the transformation

$$Y_1 = T_1(X_1, X_2) = \sqrt{-2\ln(X_1)} \cos(2\pi X_2)$$

$$Y_2 = T_2(X_1, X_2) = \sqrt{-2\ln(X_1)} \sin(2\pi X_2)$$

the joint density of  $Y_1$  and  $Y_2$

$$f_{Y_1 Y_2}(y_1, y_2) = \frac{e^{-Y_1^2/2}}{\sqrt{2\pi}} \frac{e^{-Y_2^2/2}}{\sqrt{2\pi}}$$



