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Rayleigh fading

AIM:

To perform an experiment on the Probability density function of amplitude and phase of Rayleigh distribution and compare with the theoretical pdf .

The amplitude $|Z|$ is Rayleigh distributed

$$|Z| \sim \frac{2|Z|}{P_r} e^{-\frac{|Z|^2}{P_r}}$$

The phase $\angle Z$ is uniform

Task

- Write a matlab/octave code to generate rayleigh fading samples(amplitude and phase) from gaussian random samples with variance 1
 - Plot the histogram of generated rayleigh fading amplitude samples.
 - Also plot the theoretical pdf of the rayleigh random variables ($P_r=2$)

Working Code

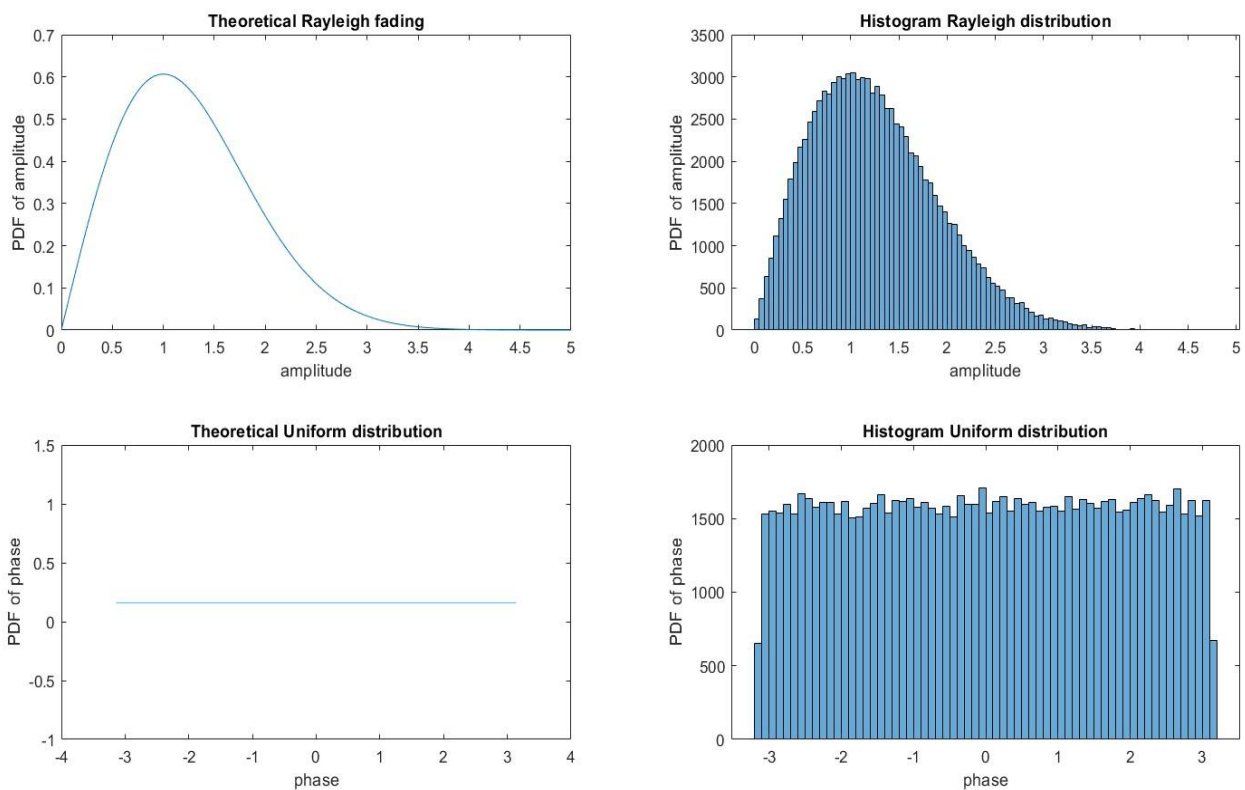
```
%Rayleigh fading
clear all; close all; clc; % Clear all data
% mean of Random Variable
mu = 0;
% variance of Random Variable
sigma = 1;
Pr = 2*sigma ;
% Number of sample
N = 100000;
% Generation of Gaussian random variable samples for real part
Rr = normrnd(mu,sigma ,1,N);
% Generation of Gaussian random variable samples for imaginary part
Ri = normrnd(mu,sigma ,1,N);
% Generation of Rayleigh complex random variable
Z = Rr+1j*Ri;
% Magnitude of Rayleigh complex random variable
Magz = abs(Z);
%Theoretical Rayleigh fading
Mag = 0:0.01:5;
Zpdf = (2.*Mag/Pr).*(exp(-1.*Mag.*Mag./Pr)) ;
subplot(2,2,1);
plot(Mag,Zpdf);
xlabel('amplitude'); % label x axis
ylabel('PDF of amplitude'); % label y axis
title('Theoretical Rayleigh fading');% Title
% Plotting of the histogram of Amplitude of Z
subplot(2,2,2);
```

```

HistMagZ = histogram(Magz);
xlabel('amplitude'); % label x axis
ylabel('PDF of amplitude'); % label y axis
title('Histogram Rayleigh distribution');% Title
%Theoretical Uniform distribution
Phase = -pi:.01:pi;
Zphase = 1/(2*pi)*ones(length(Phase));
subplot(2,2,3);
plot(Phase,Zphase);
xlabel('phase'); % label x axis
ylabel('PDF of phase'); % label y axis
title('Theoretical Uniform distribution');% Title
% Phase of Rayleigh complex random variable
Phasez = angle(Z);
% Plotting of the histogram function of phase of Z
subplot(2,2,4);
HistPhaseZ = histogram(Phasez);
xlabel('phase'); % label x axis
ylabel('PDF of phase'); % label y axis
title('Histogram Uniform distribution');% Title

```

Plot



Observation :

- Experiment on the Probability density function of amplitude and phase of Rayleigh distribution is performed and compared with the theoretical pdf.