RAYLEIGH FADING SIMULATION – YOUNG'S MODEL

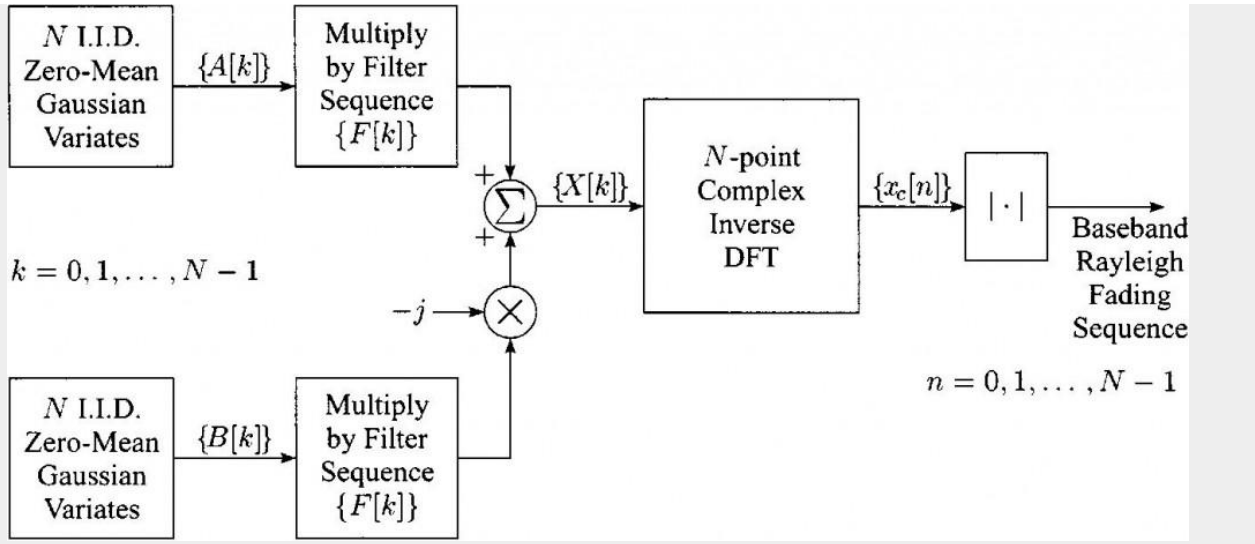
In the previous article, the characteristics and types of fading was discussed. Rayleigh Fading channel with Doppler shift is considered in this article.

Consider a channel affected by both Rayleigh Fading phenomena and Doppler Shift. Rayleigh Fading is caused due to multipath reflections of the received signal before it reaches the receiver and the Doppler Shift is caused due to the difference in the relative velocity/motion between the transmitter and the receiver. This scenario is encountered in day to day mobile communications.

A number of simulation algorithms are proposed for generation of correlated Rayleigh random variables. David J.Young and Norman C Beaulieu proposed a method in their paper titled "The Generation of Correlated Rayleigh Random Variates by Inverse Discrete Fourier Transform"[1] based on the inverse discrete Fourier transform (IDFT). It is a modification of the Smith's algorithm which is normally used for Rayleigh fading simulation. This method requires exactly one-half the number of IDFT operations and roughly two-thirds the computer memory of the original method – as the authors of the paper claims.

Rayleigh Fading can be simulated by adding two Gaussian Random variables as mentioned in my previous post. The effect of Doppler shift is incorporated by modeling the Doppler effect as a frequency domain filter.

The model proposed by Young et.al is shown below.



Rayleigh Fading – Young's model

The Fading effect + Doppler Shift is simulated by multiplying the Gaussian Random variables and the Doppler Shift's Frequency domain representation. Then IDFT is performed to bring them into time domain representation. The Doppler Filter used to represent the Doppler Shift effect is derived in Young's paper.

Source: http://www.gaussianwaves.com/2010/02/rayleigh-fading-simulation-youngs-model-2/