

# COLORED NOISE GENERATION

In communication systems the noise is mostly modeled as white noise. When there exists a noise that is “white” , then there must also exist a noise that is colored too.

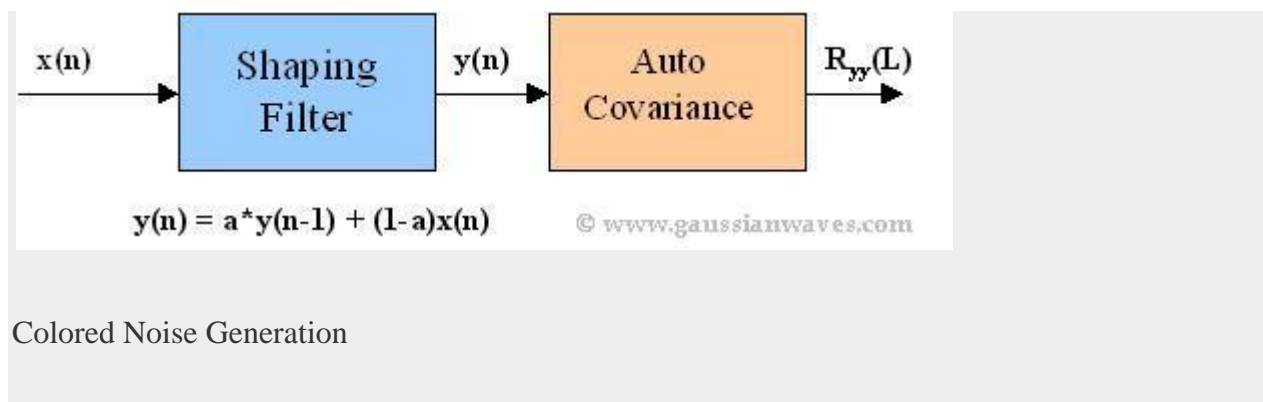
White noise has constant power spectral density across the entire frequency spectrum (extending upto infinity). There is no correlation between the samples of a white noise process at different time instances i.e. the auto correlation or the auto covariance of white noise is zero for all lags except for lag  $L=0$ . So the auto covariance of white noise process will be an impulse function at lag  $L=0$ .

## **Colored Noise:**

When the power spectral density of the noise is not uniform across the entire frequency spectrum, it is called colored noise. For a comprehensive definition of various types of colored noise refer [1]. There exist non zero values for auto correlation or auto covariance at different time instances for the colored noise. The auto covariance is maximum for zero lag ( $L=0$ ) and decreases gradually for increasing and decreasing values of lag ( $L$ ).

## Generation of Colored Noise:

Colored noise can be generated by passing the white noise through a shaping filter. The shaping filter is a dynamic filter, usually a low pass filter. The response of the colored noise can be varied by adjusting the parameters of the shaping filter. The low pass filter can be implemented in various ways in Matlab. The [Matlab's "FILTER" function](#) is used in this simulation.



Often it is stated in channel detector applications that a matched filter is the optimum detector "in the presence of white noise" since it can maximize the output SNR. In the following posts simulation of optimum matched filter in the presence of white noise/colored noise will be demonstrated.

Source: <http://www.gaussianwaves.com/2010/03/colored-noise-generation-in-matlab-2/>