

## ABSTRACT

Monte Carlo (MC) method has been applied to estimate the error probability of digital communication system. Although it has good accuracy while estimate error probability, because MC method is processing all of sample/bit needed to reach certain error probability level. However, if any system had lowest error probability, and then numbers of sample/bit processed by MC method become larger. The effect is time consumption relative becomes longer. To solve this problem, so proposed the other method, that is Importance Sampling (IS) estimation method.

Work principle of IS are based on probability density function (pdf) modification from random input process. IS method consists of two principal technique to be tried in this final project. They are Conventional IS (CIS) and Improved IS (IIS). CIS used approach by variance scaling on the origin/unbiased pdf. Whereas IIS technique based on mean translation from the origin pdf. And then, to estimate the parameter value of optimum biasing in probability error estimation processing, it tried Adaptive IS (AIS) method, also Adaptive CIS (ACIS) and Adaptive IIS (AIIS) based on recursion technique such stochastic Newton (Stochastic Gradient Descent). IS experiment is did in the optimum receiver system with coherent M-ary Phase Shift Keying (PSK) on Additive White Gaussian Noise (AWGN) channel.

From experiments results, the difference of comparison between signal power to noise power or signal to noise ratio (SNR) influenced toward optimum biasing parameter value achievement. Then, mean translation factor able to achieve speedup higher than variance scaling factor in certain SNR. Higher M-ary in PSK modulation obviously IS system has worst performance, even decreased drastically while used 8-PSK and 16-PSK. Adaptive method able to made a correction to optimum biasing factor value. In BPSK, the AIS method has a good working, which on SNR 7 dB, with Monte Carlo method used  $10^5$  samples experiment, but in AIIS, with equal estimator variance, only used approximately 250 samples, or 275 samples using calculation of speedup value and MC sample, with relative accuracy is 5 % better on confidence level 90 %. Newton recursion technique-two dimension is not significantly to improve the performance of one dimension AIS-QPSK, 8-PSK, and 16-PSK. Generally, IIS and AIIS performance is better than CIS and ACIS.