UNIVERSITY OF PERADENIYA

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Mathematical Modeling of Probability Density Functions and Applications in Wireless Communication Systems

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Master of Philosophy

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ABSTRACT

A closed form expression does not exist for the probability density function of a sum
independent and identically distributed random variables defined over the domain of positiv
real numbers $[0,\infty)$. The requirement of the evaluation of the probability density function of
sum of random variables has been of both theoretical and practical interest for many decade
The research reported in this thesis provides a general solution to the evaluation of th
probability density function for a sum of independent random variables defined over th
positive real axis.

In this study, the probability density function is expanded (approximated) in the form of a
infinite series using a modified version of Laguerre polynomials. Bounds for Laguer
polynomials, polynomial representation and convergence properties of continuous functio
are a few of the higher mathematical techniques and results that have been used to establis
the applicability of the probability density function obtained. The newly derived seri
expansion is exact for Rayleigh distribution. It can also be used to determine the PDF of th
sum when the individual independent random variables are non-identically distributed. Th
cumulative distribution function is obtained from the series expansion for the probabili
density function. The convergence of the series is established. The numerical results a
presented for the density functions and cumulative distribution functions for the sum
Nakagami random variables and Rayleigh random variables.

The newly derived series is employed to determine the error rate performance for Equal Ga
Combining (EGC) diversity reception of Coherent Phase Shift Keying (CPSK) signals
Nakagami-*m* fading channels. The numerical values for the error rates of CPSK signals f
EGC diversity are tabulated and the corresponding graphs are also sketched.