Chapter 2
Improvement for Channels With Multipath Fading (MF) Through the Methodology CBEDE

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ABSTRACT

The present study aims to implement a discrete event simulation (DES)-based model. This model is called coding of bits for entities by means of discrete events (CBEDE) and aims to improve the transmission of content in wireless telecommunication systems. This is done by applying advanced modulation format DQPSK in a simulation environment, the Simulink of the MATLAB software, through a pre-coding process of bits applying discrete events in the signal before of the modulation process, occurring in the discrete domain with the implementation of discrete entities in the process of bit generation applied at a low level of abstraction in a wireless telecommunication system. The results show improvements of 89.08% in memory utilization, related to information compression, in the context of the research. Therefore, the presented results of the proposed methodology show an enormous potential for the non-orthogonal multiple access (NOMA) contexts, credited as the future 5G, and can compensate for the additional complexity brought by the techniques to the telecommunications channel.

INTRODUCTION

Fading degrades the communication system performance due to a loss of signal power without decreasing the noise power over some or all the signal bandwidth. The probability of experiencing fading with the concomitant bit errors as the signal-to-noise ratio (SNR) drops on the channel limits the link performance. The adequate simulation of multipath fading channels is a fundamental issue in the development and evaluation of wireless systems. Since the received signal is contingent on several mutable factors, statistical models typically help to simulate fading (Curwen & Whalley, 2016).

Multipath fading (MF) affects most forms of radio communications links in one way or another. MF occurs in an environment where there is multipath propagation, and the paths change for some reason, resulting in propagating multiple versions of signals transmitted across different paths before they reach the receiver. The Rayleigh fading model is ideally suitable to typical scenarios include cellular telecommunications where there is a large number of reflections from buildings and the like and HF ionospheric communications where the uneven nature of the ionosphere means that the overall signal can arrive having taken many different paths (Yadav & Singh, 2018).

The discrete event mainly relates to the model representing the system as a sequence of operations performed on entities (transactions) of certain types such as data packets, bits, among others. These entities are discrete in a discrete event simulation. This technique is usually used to model concepts having a high level of abstraction, such as clients in a queue, emails on a server, flow of vehicles, transmission of data packets, and so forth (Campante et al., 2016).-

The modulation formats quadrature phase shift keying (QPSK) and DPSK are widely used in satellite broadcasting, in various cellular wireless standards such as GSM, CDMA, LTE, 802.16 fixed and mobile WiMAX, satellite as also cable tv applications, the DQPSK modulation is a particular form of QPSK modulation, in which instead of being sent a symbol corresponding to a pure phase parameter, this symbol represents a phase change.

Based on this, the present study aims to develop a model of information transmission based on discrete event concepts. This methodology aims to increase efficiency in sending and receiving data by reducing the consumption of time during this process. Next, we will discuss the technological concepts that involve the mobile transmission and that motivated the development of the Coding of Bits for Entities by means of Discrete Events (CBEDE) methodology presented in this chapter.

MOBILE TECHNOLOGY

The second generation of telephone technologies is called 2G (Second Generation) and this methodology was based on GSM technology. It is coming into operation around the 90s and allowed, mainly, the exchange of text messages and photos via SMS. Their focus was on voice connection, talk and be heard on the phone without the need to exist an internet connection. Subsequently, around the year 2006, the term 3G was created; and was responsible by the first cell phone technology that was born to bring fast internet to mobile phones. In its first wide-band code-division multiple access (WCDMA) standards, the maximum theoretical speed was 384 Kbits per second. In recent years, very little, but its first network appeared in 2002, where fixed broadband barely reached megabits. Another great bet of the 3G was the video calls through the cellular network, however, the service was not popularized due to the technology of the time (Curwen & Whalley, 2016; Yadav & Singh, 2018).

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