



Increasing the symbol rate in QAM system using a new set of orthonormal basics functions

A.Y. Hassan

Benha Faculty of Engineering, Benha University, Egypt

Received 26 October 2016; received in revised form 19 March 2017; accepted 22 May 2017

Abstract

This paper proposes a new technique to increase the symbol rate in Quadrature Amplitude Modulation (QAM) using a new set of orthonormal functions. The proposed technique increases the rate of QAM symbols without increasing the bandwidth of the modulated signal or increasing the modulation order of the QAM symbol. The set of orthonormal functions consists of four shaped-sinusoidal functions. The shaping functions are Hilbert-Transform pair. The proposed QAM modulator modulates two independent complex symbols in the same time. Each modulated symbol uses two different functions from the proposed set. The paper shows the structure of the modulator and demodulator of the proposed system. The paper presents different shaping pulses, which can be used with the proposed system.

© 2017 Production and hosting by Elsevier B.V. on behalf of Electronics Research Institute (ERI). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Quadrature amplitude modulation; Orthogonal shaping shapes; Hilbert transform; Complex exponential carriers; Inter-symbol interference

1. Introduction

Many works focus on improving the performance of digital communication systems in linear and time-varying channels. Some works are interested in the power efficiency of digitally modulated systems. They improve the power efficiency by using channel coding and space-diversity techniques (Yu et al., 2014; Declercq et al., 2014; Joung and Sun, 2014; Yang et al., 2014; Majumdar et al., 2012). A combination of channel coding and space diversity took many interests in the last decades. Several efforts are spent in this research area. These efforts are crowned with the appearance of Multiple-Input-Multiple-Output (MIMO) systems. MIMO systems give good performance in time-varying channels. MIMO systems are used in many wireless applications such as WIFI and WIMAX networks (Roshan and Single, 2014; Hanzo et al., 2010).

E-mail address: ashraf.fahmy@bhit.bu.edu.eg

Peer review under the responsibility of Electronics Research Institute (ERI).



Production and hosting by Elsevier

<http://dx.doi.org/10.1016/j.jesit.2017.05.007>

2314-7172/© 2017 Production and hosting by Elsevier B.V. on behalf of Electronics Research Institute (ERI). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Please cite this article in press as: Hassan, A.Y., Increasing the symbol rate in QAM system using a new set of orthonormal basics functions. J. Electr. Syst. Inform. Technol. (2017), <http://dx.doi.org/10.1016/j.jesit.2017.05.007>