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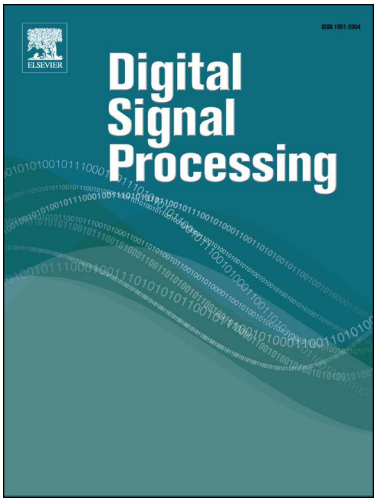

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Wei-Chieh Chang, Jenq-Tay Yuan

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Finite-Length Predictive Decision Feedback Equalizer Design for Multipath Channels with Large Delay Spread

Wei-Chieh Chang [a,*], Jenq-Tay Yuan [b]

[a] *Graduate Institute of Applied Science and Engineering, Fu Jen Catholic University, New Taipei City 24250, Taiwan.*
[b] *Department of Electrical Engineering, Fu Jen Catholic University, New Taipei City 24250, Taiwan.*
** Corresponding author. E-mail address: ja0613ck@gmail.com. (W.-C. Chang)*

Abstract—Decision feedback equalizers (DFEs) have been widely used to mitigate the effect of intersymbol interference. Most previous studies have focused on conventional DFEs (CDFEs), and relatively little research has addressed predictive DFEs (PDFEs). A finite-length minimum-mean-squared-error predictive DFE (MMSE-PDFE) was developed herein in the presence of multipath channels with large delay spread. We found that the MMSE-PDFE may have lower computational complexity and achieve a better symbol error rate performance than the existing MMSE-CDFE. Therefore, the proposed MMSE-PDFE may offer a viable alternative to the MMSE-CDFE. Computer simulations were conducted to verify our results using highly dispersive multipath channels.

Keywords—Conventional decision feedback equalizer (CDFE), decision feedback equalizer (DFE), minimum mean-squared error (MMSE), multipath channels, predictive decision feedback equalizer (PDFE)

1. Introduction

Decision feedback equalizers (DFEs) are equalization structures that are widely used to eliminate severe intersymbol interference (ISI), and their computational complexity is considerably lower than that of nonlinear maximum-likelihood receivers. DFEs are used in digital television (DTV) systems, high-speed chip-to-chip links, underwater acoustics (UWA), and optical fiber communications [1–11], and can be found in many practical channels that are characterized by long and sparse channel impulse responses (CIRs) spanning more than 100 symbol periods because of large delay spreads. The structure of an infinite-length conventional DFE (CDFE) was first proposed by Austin [12], followed by the derivation of the infinite-length CDFE by Salz [13] under the minimum-mean-squared-error (MMSE) criterion (MMSE-CDFE) and its subsequent finite-length counterpart proposed by Al-Dhahir and Cioffi [14] and Casas et al. [15]. A thorough analysis of the structure and

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