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Review of FBG and DCF as dispersion management unit for long haul optical links and WDM systems

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Abstract
This report presents a comprehensive approach to dispersion management, including various techniques, mathematical analysis, and their advantages and disadvantages in different scenarios. A deep mathematical analysis of chirped fiber Bragg grating (CFBG) is conducted for various chirping techniques and apodization profiles, highlighting the importance of this aspect in dispersion management. Additionally, a detailed study of the implementation of CFBG and dispersion compensating fiber (DCF) is performed to determine which technique is suitable for long-haul links and which is best for WDM networks, both for low and high capacity. The report also sheds light on how dispersion compensation techniques can be useful in mm wave propagation. The paper provides new insights into the field of dispersion management and the results of the study make it an interesting and valuable addition to the literature.

Keywords Dispersion · Dispersion compensation · Wavelength-division multiplexing (WDM) · Dispersion compensating fiber (DCF) · Fiber Bragg grating (FBG) · Pulse spreading

1 Introduction

Optical fiber communication was introduced roughly three decades ago and quickly became the preferred method in telecommunications due to its numerous advantages, particularly its vast capacity and security (Sharma et al. 2019; Senior and Jamro 2009; Keiser 2000, Agarwal 2012). However, the issue of dispersion limits the ability of optical systems to meet the needs of users (Sharma et al. 2019; Senior and Jamro 2009; Keiser 2000). Dispersion is the effect that causes pulse broadening as it propagates through the fiber (Senior and Jamro 2009; Keiser 2000). If this pulse broadening exceeds a certain threshold, it leads to Inter-symbol Interference (ISI) (Senior and Jamro 2009; Keiser 2000; Bhupeshwaran

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