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Isochronous and Anisochronous Modulation Schemes in Wireless Optical Communication Systems

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Abstract— The choice of the modulation format is one of the principle factors in realizing a high performance wireless optical communication system at a reasonable cost and acceptable complexity. The purpose of this paper is to make a comparison between isochronous and anisochronous modulation scheme categories from Discrete (digital) pulse time modulations (PTM) through the simplest scheme in each family; PPM and DPIM respectively, in term of bandwidth requirement, power efficiency and transmission capacity. This is done to give a wider view on the performance of such schemas under wide range of design parameters.

In this paper, the properties of PPM and DPIM have been analyzed, from this analysis it has been shown that DPIM or anisochronous modulation schemes in general are strong candidates when synchronization and transmission capacity are taken into account, and when it comes to power performance PPM or isochronous modulations are better.

Index Terms— Isochronous, anisochronous, PPM, DPIM, bandwidth requirement, power efficiency, transmission capacity

I. INTRODUCTION

The optical channel is usually treated as an Intensity Modulation and Direct Detection (IM/DD) channel [1]. For IM/DD, The modulation OOK (On-Off Keying) is the simple and widely adopted modulation scheme used in commercial FSO communication systems because of ease in implementation, simple receiver design, bandwidth efficiency and cost effectiveness [2]. On the other hand, higher average power efficiency can be achieved by employing Discrete Pulse Time Modulation (PTM) schemes in which a range of time dependent features of a pulse carrier may be used to convey information.

Discrete (digital) pulse time modulations (PTM) techniques fall into two categories, namely isochronous and anisochronous. Isochronous schemes encode data by varying the position or width of a pulse, but the overall symbol structure remains constant, in contrast, anisochronous schemes have no fixed symbol structure [3], a simple Digital Pulse Time Modulations (PTM) tree is shown in Fig. l.

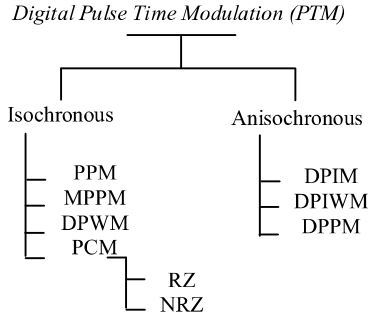

Figure. 1 Digital Pulse Modulations Tree

In this paper we will try to make a comparative analysis between isochronous and anisochronous modulation categories presented by PPM (Pulse Position Modulation) and DPIM (Pulse Interval Modulation) respectively. This comparison is made to understand the basic characteristics of each modulation family, what features make such modulation category desirable and which one outperform the other depending on the circumstances

