Augmenting Pedagogical Practices Through Innovative Technological Interventions

Maneesha, Praveen Kant Pandey* and Tripti Gupta

Abstract

The ubiquitous educational technologies due to technological growth and development has led to significant advancement in practices adapted by teachers globally to educate children. Students are 'learning by doing' and 'technology enhanced learning'. In such a scenario, laboratories become a core requirement, in particular in science education for skill training and better understanding of concepts. The present paper seeks to research and analyze comprehensively the various educational technologies available addressing the concern for the flexible use of teaching spaces along with ensuring aquality learning experience for Undergraduate students when on campus and off campus. Cost effective models have been proposed for both students on campus as well as for the under privileged section of students to provide quality education by reaching out to such needy children through participatory and interactive methods. Each model was accomplished by engaging students at every level of the project, i.e., designing, creation of digital content, controlling and monitoring and its management and evaluation assessment.

Keywords: *Educational Technologies, Technology Enhanced Learning, Student Centric Learning, Scientific Inquiry*

Introduction

The drastic changes in the education system has given rise to significant advancement in practices adopted by teachers for teaching and learning due to all-pervading educational technologies. The use of new and innovative education technologies and strategies entail a paradigm shift from simple chalk and talk methods to practical and hands-on based learning in classrooms. This

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Design of the coaxial optical fiber for pulse repetition rate multiplication by Talbot effect

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ABSTRACT

In this paper, we propose the use of a coaxial fiber as a suitable first order dispersive medium to achieve pulse repetition rate multiplication by use of the temporal Talbot effect. A design optimization of the coaxial fiber is discussed to achieve first order dispersion over a desired bandwidth. Pulse repetition rate multiplication is demonstrated by simulating the propagation of a Gaussian pulse train through the coaxial fiber using analytical expressions. The results are compared with those obtained in an ideal first order dispersive medium and by use of the conventional single mode fiber.

1. Introduction

High repetition rate optical pulse sources can significantly improve the performance of high-capacity telecommunication systems, photonic switching devices and high speed electro-optic sampling techniques. The optical pulses with high repetition rate can be used as an optical clock and as a data transmission source. Moreover, a pulse train source eliminates the need for a modulator to create the pulses which simplifies the system architecture, increases efficiency and reduces cost. In addition, the quality of the pulses is much better than the one obtained by modulating a CW source resulting in the improvement of signal to noise ratio, which in turn allows higher repetition rates through optical time-division multiplexing.

Narrow pulses of the order of picoseconds can be generated using mode locked lasers but high repetition rate is limited by the physical length of the cavity in case of passive mode locking [1,2]. In active mode locking, the repetition rate is limited by the electrical bandwidth of the modulator and its driving electronics [3]. For higher repetition rates harmonic mode locked lasers can be used but in general it is difficult to control the operation of this kind of laser [4].

Another way to obtain higher repetition rate is to multiply the repetition rate of the optical pulses outside the laser cavity. This can be achieved either by amplitude filtering or phase filtering. In amplitude filtering, the Pulse Repetition Rate Multiplication (PRRM) is obtained by selecting the frequency components corresponding to the required bit-rate and suppressing the other harmonics [5]. An example of such kind of filter is a Fabry-Perot filter with a free spectral range corresponding to the desired bit-rate.

In phase filtering, the spectral amplitudes of the pulse train remain same. The type of phase filter which serves the purpose of multiplying the repetition rate of pulses is the quadratic phase only filter [6]. A first order dispersive medium, i.e., a medium with a constant Group Velocity Dispersion (GVD) over a desired frequency range, behaves as a quadratic phase filter. When a periodic pulse train passes through such a medium, the different frequency components undergo different delays, which vary linearly with frequency, resulting in the repetition of the original pulse train after a certain distance, known as the Talbot length z_T. If a pulse train with individual pulses of width $2\tau_0$ and repetition period T travels through a dispersive medium, with a constant GVD β_2, the Talbot length is given by $z_T = T^2/(2\pi\,|\beta_2|)$. For a propagation distance $z_T * s/q$, where s and q are co-prime integers, the output pulse train will have pulse repetition period of T/q or a repetition rate equal to q-times the input repetition rate. This effect is known as the fractional temporal Talbot effect as it is analogous to the near field diffraction effect or spatial Talbot effect, which was first observed by Henry Fox Talbot in 1836 [7]. Many authors have reported PRRM by temporal Talbot effect using various dispersive components [8–11]. Among other applications, temporal Talbot effect has been used in optical implementation of factorization of numbers [12] and noiseless intensity amplification of a periodic sequence of pulses [13,14]. All optical clock recovery has also been demonstrated in Single Mode Fiber (SMF) using the temporal Talbot effect [15].

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PAPER

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