

利用多功能液晶元件之 十六通道高密度分波多工器之解多工器之研究

研究生：賴奕帆

指導老師：潘犀靈 教授

國立交通大學光電工程研究所

摘要

在本論文中，我們發展利用液晶元件之十六通道-可調光解多工器和其液晶像素強度回饋控制系統。它是由摻鉍光纖放大器、準直鏡、削角入射光柵、成像透鏡、穿透式之液晶空間光調制器、作為輸出用的光纖陣列、光譜儀、光探測器、數位可變電阻及個人電腦所組成。其光柵一階繞射光經過透鏡聚焦在液晶空間調制器與光纖陣列上。選取適當的液晶空間調制器像素使得想要的波長穿透並由光纖陣列所接收。十六頻道之每一頻道中心波長針對國際電信聯盟所訂定頻道間距 100GHz 波長所設計，頻道串音小於 -30 dB，平均 1/3 dB 穿透頻寬分別是 12.5/22.5 GHz，各頻道中心波長精確到 0.04 nm，液晶空間光調制器之平均消光率為 13.53 dB。我們利用液晶空間光調制器以手動調制方式將十六頻道的強度等化至 -65 dBm，將原本約 10 dB 之頻道強度差減少至 0.5 dB。

我們設計液晶元件之十六通道-可調光解多工器之液晶像素強度回饋控制系統來進一步降低其強度擾動與更簡易控制液晶元件光解多工器。我們選擇四個頻道來做液晶像素回饋控制，使得四頻道波長功率擾動可穩定至 1.2% 或 0.052 dB 且可任意控制各頻道之輸出強度。

A Study of 16-Channel Optical Demultiplexer for DWDM with Liquid Crystal Enabled Functionalities

Student: Yi-Fan Lai

Advisor: Prof. Ci-Ling Pan

Institute of Electro-Optical Engineering
College of Electrical Engineering and Computer Science
National Chiao Tung University

Abstract

We have designed and demonstrated a liquid-crystal-based 16-channel tunable optical DEMUX and Optical Demultiplexer feedback control Pixel Equalizer. It consists of EDFA, a collimating lens, grazing-incident grating, image lens, a transmission-type liquid crystal spatial light modulator (LC-SLM), fiber array for output, OSA, photodetector, and digital variable resistor, and computer.

In this system, first-order diffracted signal light by the grating is directed to the image lens and focused on to the LC-SLM and fiber array. Selecting the appropriate LC-SLM pixels allows light of the desired wavelength to transmit into the fiber array. The center wavelengths of the channels are designed and the channels are designed according to the International Telecommunication Union (ITU) grid with channel spacing of 100 GHz. The crosstalk between channels is less than -30 dB. The average 1 dB and 3 dB passbands of the DEMUX are 12.5 and 22.5 GHz, respectively. The center wavelength of each channel is accurate to 0.04 nm. The extinction ratios for pixels on/off for the 16 channels range from 11.1 dB to 16.2 dB. The average extinction ratio is 13.53 dB. The outputs of the channels of the LC-multi-DEMUX are equalized to -65 dBm and the variation between different channels are reduced from ~ 10 dB to less than 0.5 dB.

We have demonstrated optical demultiplexer feedback control pixel equalizer to reduce ripple level and easy to control of LC-multi-DEMUX. We selected four channels to feedback control the power level, the fluctuation is reduced to 1.2% or 0.052dB. We can modulate the transmittance of LC-SLM to adapt to the different conditions and change the each channel power easily independently by PC.

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