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## 论文

包含掺铒光纤和微结构光纤的光纤环镜光开关

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### 摘要:

设计了一种低开关功率的全光开关.将掺铒光纤和微结构光纤引入Sagnac环境中,信号光在泵浦光作用下经过掺铒光纤被放大,破坏了环境的平衡,利用交叉相位调制效应使两束反向传输的信号光产生非线性相移,实现了光开关效应.理论分析表明:信号光经过掺铒光纤后,增益越大微结构光纤的非线性系数越高,开关功率越低,并且环境信号光的透射率随两束反向传输信号光的相移差成余弦变化.仿真得到开关功率约为26.73 mW,与理论分析一致.

**关键词:** 非线性光学 全光开关 交叉相位调制 掺铒光纤 微结构光纤

## Optical Switch Based on Optical Loop Mirror with Erbium-doped Fiber and Microstructure Fiber

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### Abstract:

A low switching-power all-optical switch was designed.The erbium-doped fiber and the microstructure fiber were inserted into the Sagnac loop mirror simultaneously.Under the effect of the pump modulation,signal light was amplified when passing the erbium-doped fiber.The symmetry of the loop was broken,two counter-propagating signal lights in the loop acquire nonlinear phase due to the cross-phase modulation effect,and the light switch was realized.The theoretical analysis shows that while the signal light goes through erbium-doped,the larger gain it gets,and the higher coefficients of the microstructure fiber is,the lower switch power is.Furthermore,the transmission rate of signal light in the loop varies with the phase difference of the two counter-propagating signal lights into cosine changes.the simulation results shows that switching power is 26.73 mW,which agrees with the theory.

**Keywords:** Nonlinear optics Optical switch Cross-phase modulation Erbium-doped fiber Microstructure fiber

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### 参考文献:

- [1]ANG Rui-li,WEN Wen-long,ZHAO Bao-shen,et al.A high speed electro-optical switch with fiber optic array[J].Acta Photonica Sinica,2009,38(9):2210-2213.  
张蕊利,温文龙,赵宝升,等.一种基于光纤阵列的高速电光开关系统[J].光子学报,2009,38(9):2210-2213.
- [2]KRAHENBUHL R,HOWERTON M M,DUBINGER J,et al.Performance and modeling of advanced Ti:LiNbO3 digital optical switches[J].Lightwave Technology,2002,20(1):92-99.
- [3]YANG Guang-qiang,ZHANG Xia,REN Xiao-min,et al.Experimental research on all-optical switch based on photonic crystal fiber[J].Chinese Journal of Lasers,2005,32(12):1650-1653.  
杨广强,张霞,任晓敏,等.基于光子晶体光纤的全光开关实验研究[J].中国激光,2005,32(12):1650-1653.
- [4]BLOW K J,DORAN N J,NAYAR B K.Experimental demonstration of optical soliton switching in an all-fiber nonlinear Sagnac interferometer[J].Optics Letters,1989,14(14):754-756.
- [5]LIU Jian-Guo,KAI Gui-Yun,XUE Li-Fan,et al.A all-optical switching based on highly nonlinear photonic crystal fiber Sagnac loop mirror[J].Acta Physica Sinica,2007,56(2):941-945.  
刘建国,开桂云,薛力芳,等.基于高非线性微结构光纤Sagnac环形镜的全光开关[J].物理学报,2007,56(2):941-945.
- [6]CHEN Ming,XU Mai,LI Chun-fei,et al.Optical switch and bistability based on nonlinear one-dimensional photonic crystals[J].Acta Photonica Sinica,2005,34(1):98-101.  
陈明,李淳飞,徐迈,等.非线性一维光子晶体光开关与双稳态[J].光子学报,2005,34(1):98-101.
- [7]AGRAWAL G P.非线性光纤光学原理及应用[M].贾东方,余震红,等译.北京:电子工业出版社,2002:13-356.
- [8]CHEN Lin,XU Jun,SHAO Xiao-peng,et al.Study on noise figure and gain of EDFA[J].Study On Optical Communications,2006,133(1):52-55.  
陈琳,徐军,邵晓鹏,等.掺铒光纤放大器增益和噪声研究[J].光通信研究,2006,133(1):52-55.
- [9]PANG Yong,JING Pei-xuan,XU Da-xiong.Numerical analysis of small signal characteristics of an EDFA pumped at 1480 nm[J].Chinese Journal of Quantum Electronics,1996,13(1):40-45.  
庞勇,蒋佩璇,徐大雄.1480 nm泵浦的掺铒光纤放大器的小信号特性分析[J].量子电子学,1996,13(1):40-45.
- [10]胡先志.光器件及其应用[M].北京:电子工业出版社,2010:190-202.
- [11]WU Ming,LIU Hai-rong,HUANG De-xiu.Analysis of nonlinear coefficient of highly nonlinear photonic crystal fibers[J].Study on Optical Communications,2007,5(1):45-46.  
吴铭,刘海荣,黄德修.高非线性微结构光纤非线性系数的分析[J].光通信研究,2007,5(1):45-46.
- [12]CUI Guo-qi,DONG Xiao-yi,ZHANG Jian-zhong,et al.Character analysis on erbium-doped fiber amplifications pumped with CW and pulse light sources[J].Laser and Infrared,1992,22(1):26-29.  
崔国琪,董孝义,张建忠,等.连续泵浦与脉冲泵浦掺铒光纤光放大特性分析[J].激光与红外,1992,22(1):26-29.

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1. 袁明辉;张明德;孙小蕊.偏振模色散对非线性光纤环镜微波光子开关的影响及其补偿[J].光子学报,2006,35(7):1008-1012
2. 李文兵;赵国忠;王福合;周云松.半导体超晶格子带间跃迁光吸收理论研究[J].光子学报,2006,35(1):61-64
3. 吕翎;赵鸿雁;邹成业.单模激光Haken-Lorenz系统的振荡解析解[J].光子学报,2006,35(8):1179-1182
4. 姜其畅,苏艳丽,吉选芒.基于双光子光折变效应的非相干耦合灰光孤子族[J].光子学报,2011,40(4):552-555
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[J]. 光子学报, 2007,36(3): 448-451

6. 谭鹏 郭康贤 路洪.加偏置电场的双曲线量子阱中的光整流效应[J]. 光子学报, 2007,36(5): 812-815

7. 杨淑连.一种新型光纤压力传感器的设计[J]. 光子学报, 2007,36(5): 838-841

8. 米剑 张春熹 李铮 邬战军.掺铒光纤超荧光光源平均波长温度稳定性实验研究[J]. 光子学报, 2007,36(5): 825-829

9. 何理;杨伯君;于丽;张晓光.基于Sagnac干涉仪的混合锁模光纤激光器[J]. 光子学报, 2007,36(1): 5-8

10. 胡涛平;颜森林;罗青.零色散附近的交叉相位调制不稳定性分析[J]. 光子学报, 2006,35(9): 1367-1373

11. 周亚训;陈芬;徐铁峰;聂秋华.宽带放大器用碲基掺铒光纤结构参量的设计考虑[J]. 光子学报, 2006,35(7): 1038-1042

12. 李国超,任诠,王新强,杨洪亮,陈经纬,蔡宁宁.适用于全光开关的[(C3H7)4N][Au(C3S5)2]三阶非线性光学性质研究[J]. 光子学报, 2011,40(4): 547-551

13. 王秀琳;黄文财.新颖的双通道输出高功率掺铒光纤宽带光源[J]. 光子学报, 2007,36(1): 124-127

14. 许洪涛;蔡志岗;王长顺.新型含偶氮聚合物薄膜表面微结构的刻写研究[J]. 光子学报, 2006,35(3): 385-388

15. 陈容睿;饶云江;冉曾令;聂玲.

基于喇曼/掺铒光纤混合放大的长距离布喇格光栅传感器系统

[J]. 光子学报, 2007,36(3): 507-510

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