## **Contents**

1	Intr	Introduction					
	1.1	Backg	round	1			
	1.2	Fiber	Lasers	2			
		1.2.1	Background and Tendency of Fiber Lasers	3			
		1.2.2	New Wavelength Fiber Lasers	4			
	1.3 Nonlinear Effects in Fibers						
		1.3.1	Self-Phase Modulation	6			
		1.3.2	Cross-Phase Modulation	7			
		1.3.3	Stimulated Raman Scattering	7			
		1.3.4	Four-Wave Mixing	9			
	1.4		nic Crystal Fibers	12			
	1.5	Motiv	ation of Thesis	13			
	1.6	Thesis	S Organization	14			
	Refe	References					
2	New Wavelength Generation Based on PCF with Two						
	Zero-Dispersion Wavelengths (TZDWs)						
	2.1		pole Method	19			
	2.2	Param	netric Amplification Based on PCF with TZDW	20			
		2.2.1	The Design and Fabrication of the PCF with TZDW	20			
		2.2.2	The Relationship Between the Optical Parametric				
			Spectrum and the Pump Wavelength	24			
		2.2.3	The Optical Parametric Generation in a PCF				
			with TZDW	27			
	2.3	Dispe	rsive Wave Generation				
		2.3.1	The Principle of Dispersive Wave Generation				
		2.3.2	•				
		222	<u> </u>	3/			

xii Contents

	2.4	Ultraviolet Generation Based on Cross-Phase Modulation				
		in PCF with TZDW	35 37			
	2.5					
	Refe	erences	38			
3	PCF-Based Optical Parametric Amplifier (OPA)					
	3.1	Introduction	41			
	3.2	Parametric Generation in a PCF with ZDW Near 1.06 $\mu m \dots$ .	43			
	3.3	OPA Based on PCF Pumped by Picosecond Light Source	49			
		3.3.1 The Theory of Pulsed OPA	49			
		3.3.2 High-Gain Broadband FOPA	51			
		3.3.3 Widely Tunable Parametric Amplification	55			
		3.3.4 FOPA-Based Picosecond Pulse Generation	56			
	3.4	Conclusion	57 58			
	Refe	References				
4	Widely Tunable Optical Parametric Oscillator (OPO)					
	Based on PCF					
	4.1	Introduction	59			
	4.2	Wavelength Tuning Methods	60			
	4.3	Wavelength Tunability via Tuning of the Pump Wavelength	62			
	4.4	Time-Dispersion-Tuned OPO Based on PCF	67			
	4.5	Conclusion	77			
	Refe	erences	78			
5	PCF-Based OPO with High Energy Conversion Efficiency					
	5.1	Introduction	81			
	5.2	Doubly Resonant PCF-Based OPO	82			
		5.2.1 Four-Wavelength FOPO	84			
		5.2.2 Doubly Resonant FOPO with High Conversion				
		Efficiency	84			
	5.3	Highly Efficient PCF-Based OPO with All-Fiber Cavity				
		Structure	89			
	5.4	Conclusion	91			
	References					
6	Con	clusion	93			