

# Contents

<b>1</b>	<b>Introduction</b> . . . . .	1
1.1	Background of Study . . . . .	1
1.2	Problem Statement . . . . .	2
1.3	Research Objective . . . . .	2
1.4	Scope of Research . . . . .	3
1.5	Significance of Research . . . . .	3
<b>2</b>	<b>Literature Review</b> . . . . .	5
2.1	Introduction . . . . .	5
2.2	Historical Background . . . . .	5
2.3	Bright and Dark Solitons . . . . .	6
2.4	Optical Trapping . . . . .	6
2.5	Temporal Solitons . . . . .	12
2.6	Microring Resonator System . . . . .	14
<b>3</b>	<b>Theory</b> . . . . .	17
3.1	Introduction . . . . .	17
3.2	Ring Resonator System . . . . .	17
	3.2.1 Single Ring Resonator . . . . .	18
	3.2.2 Add-Drop Configuration . . . . .	20
3.3	Fibre Nonlinearity . . . . .	22
3.4	Nonlinear Kerr Effect . . . . .	24
3.5	Resonance Characteristics . . . . .	27
	3.5.1 Bandwidth . . . . .	27
	3.5.2 Finesse . . . . .	28
	3.5.3 Free Spectral Range . . . . .	28
	3.5.4 Quality Factor . . . . .	30
3.6	Optical Tweezers . . . . .	31
3.7	Self-phase Modulation . . . . .	33

3.8	Photonics Signal Flow Graph Theory . . . . .	35
3.8.1	Transmission Rule . . . . .	36
3.8.2	Addition Rule . . . . .	36
3.8.3	Product Rule . . . . .	37
3.9	Z-Transform Method. . . . .	37
<b>4</b>	<b>Research Methodology . . . . .</b>	<b>41</b>
4.1	Introduction . . . . .	41
4.2	Add-Drop Configuration System . . . . .	41
4.3	PANDA Ring Resonator System . . . . .	49
4.3.1	Right Nanoring of PANDA Ring Resonator System . . . . .	50
4.3.2	Left Nanoring of PANDA Ring Resonator System . . . . .	51
4.4	Modelling Consideration . . . . .	53
4.4.1	Add-Drop Configuration System Modelling. . . . .	53
4.4.2	PANDA Ring Resonator System Modelling . . . . .	56
4.5	Applications of the PANDA System for Photodetector Technology . . . . .	59
<b>5</b>	<b>Results and Discussion . . . . .</b>	<b>63</b>
5.1	Introduction . . . . .	63
5.2	Add-Drop Configuration System . . . . .	63
5.3	Ring Radius of Add-Drop System . . . . .	64
5.4	Coupling Coefficient of Add-Drop System . . . . .	66
5.4.1	Variation of $\kappa_1$ Towards Add-Drop System. . . . .	67
5.4.2	Variation of $\kappa_2$ Towards Add-Drop System. . . . .	69
5.5	Optimization of Add-Drop Configuration System . . . . .	71
5.6	PANDA Ring Resonator System . . . . .	71
5.7	Ring Radii of PANDA System. . . . .	74
5.7.1	Center Ring Radius . . . . .	74
5.7.2	Right and Left Nanorings . . . . .	76
5.8	Coupling Coefficient of PANDA System. . . . .	78
5.8.1	Variation of $\kappa_1$ and $\kappa_2$ . . . . .	78
5.8.2	Variation of $\kappa_3$ and $\kappa_4$ . . . . .	81
5.9	Input Power of PANDA System. . . . .	83
5.10	Optimization of PANDA Ring Resonator System. . . . .	85
5.11	Optical Tweezers for Photodetector Performance Improvement. . . . .	86
<b>6</b>	<b>Conclusion . . . . .</b>	<b>91</b>
	<b>References . . . . .</b>	<b>93</b>
	<b>Index . . . . .</b>	<b>99</b>



<http://www.springer.com/978-3-319-15484-8>

Simulation of Optical Soliton Control in Micro- and  
Nanoring Resonator Systems

Daud, S.; Idrus, S.M.; Ali, J.

2015, XIII, 100 p. 38 illus., 28 illus. in color., Softcover

ISBN: 978-3-319-15484-8