Preface

Praise be to Allah s.w.t… Peace and Blessing be to Prophet Muhammad s.a.w…

In preparation of this research book, we were in contact with numerous researchers and academicians. They have contributed toward the understanding and thoughts of Physics and communication systems link. In particular, we wish to express our sincere appreciation and gratitude to Prof. Dr. Preecha P. Yupapin from KMITL, Thailand, Prof. Dr. Noriah Bidin from Laser Centre, Ibnu Sina ISIR, and Dr. Saktioto from the Physics Department, Universiti Teknologi Malaysia for their motivations and support. Also, we like to thank our family members for their patience. Without their continued support and interest, the completion of this book would definitely have been impossible.

This research book serves to design and analyze the optical soliton control in micro- and nanoring resonator systems. Optical soliton control in communication and sensors is performed with the ring resonator systems described in the book. The ring resonator systems are optimized as optical tweezers for photodetection. Numerous arrangements and configurations of micro- and nanoring resonator systems are explained. The analytical formulation and optical transfer function for each model and the interaction of the optical signals in the systems are discussed. The book shows that the models designed are able to control the dynamical behavior of generated signals.

This research book consists of six chapters, namely as Introduction, Literature Review, Theory, Research Methodology, Results and Discussion, and Conclusion. The background of study, problem statements, scope, and significance of research is discussed in Chap. 1. The objectives of the research are also explained in details. Literature reviews of the research are discussed in Chap. 2. The characteristics of bright and dark solitons, temporal solitons, optical trapping, and historical perspective of ring resonators are described in this chapter. Chapter 3 explains the theoretical part of the research. The fundamental principles of ring resonator are discussed in details. The nonlinearity of the optical solitons is discussed based on the Kerr effect of optical fibre waveguides. The resonance characteristics of the fibre is also presented. Besides, the basic principles of SPM, SFG, and Z-transform

methods are also explained in this chapter. The mathematical formulation, modeling, and description of add-drop and PANDA ring resonator systems are explained in Chap. 4. The derivation of add-drop and PANDA ring resonator systems arrangements are discussed precisely. The transfer function of each model designed is derived based on the actual practical device values. The flowcharts that perform the simulation processes are described. Chapter 5 explains the results and discussions of the research findings. All parametric effects toward the system performance are discussed in details. The optimization process for both add-drop and PANDA ring resonator systems are explained accordingly. At the end, the conclusions of this research work are described in Chap. 6.

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