

Chapter 1

Introduction



Integrated ring resonators have emerged in the last years in integrated optics and have found their way into many applications and are still highly relevant both in applied and advanced research. Integrated ring resonators do not require facets or gratings for optical feedback and are thus particularly suited for monolithic integration with other components. The wavelength and thus frequency response from coupled ring resonators can be custom designed by the use of different coupling configurations. In this way for example, the response from ring resonator filters can be designed to have a flat top and steep roll off. Other coupling configurations lead for example to a ring resonator reflector device, which can be used on one side or on both sides of an integrated semiconductor optical amplifier serving as a laser. Numerous examples of ring resonator applications exist and several of them are highlighted in this book, demonstrating their unique use.

Ring resonators do not only find applications in optical networks, they have recently been demonstrated to be used as sensors and biosensors.

The book is organized as follows: Chap. 2 covers the main aspects of ring resonator theory. Chapter 3 gives an overview of the various fabrication methods and material systems. Chapter 4 serves as a brief introduction into the building blocks of ring resonator devices like couplers and bends. Chapter 5 describes the numerous applications of fabricated ring resonator devices. Chapter 6 highlights sensors and related applications whilst Chap. 7 provides a short introduction into whispering gallery mode resonators. The book ends with an outlook given in Chap. 8.

The intention of the authors is to provide the reader with a comprehensive starting point into this hot topic of integrated ring resonators fulfilling the requirement of a true compendium.