

Preface

In the 21st Century, information technology will be essential for realizing a world-wide communication network. Optical transmission using a short optical pulse train is a fundamental technology for achieving a high-speed and long distance global network. Pulse propagation in optical fiber communication systems is affected by the fiber nonlinearity even at relatively low power levels. One example of the action of nonlinearity is the formation of solitons in anomalous dispersion fibers. Among many optical transmission formats, an optical soliton, which is created by balancing the anomalous group velocity dispersion with the fiber nonlinearity, called the self-phase modulation, offers great potential for realizing an advanced optical transmission system, since the soliton pulse can maintain its waveform over long distances. An ideal soliton can exist only in a lossless fiber with constant dispersion. Interest in optical solitons has grown steadily in recent years. The field has considerable potential for technological applications, and it presents many exciting research problems both from a fundamental and an applied point of view. Now, about a quarter of a century after the first theoretical predictions of optical solitons, the industrial application of the optical soliton concept is close to becoming reality in the booming field of modern telecommunications, where the demand for high-speed data transmission and routing is constantly growing. However, all real systems have losses and varying dispersion, which severely degrades the quality of the optical soliton pulse. Recent progress in optical soliton technology has overcome these difficulties by introducing the idea of dispersion compensation. Various technologies have arisen in the race to move more bits of data faster and farther, with increasing reliability and decreasing costs.

Solitons are one among many exciting new technologies emerging in optical networking and they are poised to benefit the commercial ultra-long-haul all-optical multi-terabit networks spanning distances up to many millions of kilometers. It could well become one of the fundamental technologies in the current communication revolution. Solitons are localized nonlinear waves having stable properties which allow them to propagate very long distances with little change. New optical devices are in various stages of development: Soliton information processing is the most advanced one. In the last decade, many distinguished physicists and mathematicians have contributed to the relevant research. However, to a large extent the various communities involved – engineers, physicists and mathematicians – still operate within their own boundaries. One of the

purposes of this volume is to feature articles that bring together different perspectives, with the hope of stimulating future interaction between researchers with different backgrounds. Reflecting the importance of optical solitons in future technologies, in this book, we include articles written by eminent scientists in the field. To reach a diversified audience, a pool of internationally renowned scientists has generously contributed articles treating the different aspects of soliton engineering that they have mastered. The editors wish to thank them warmly for devoting their valuable time to the preparation of these articles. We believe that we have covered a majority emerging areas of optical solitons and their applications. We are happy to bring out this volume, a compilation of articles from experts, and hope that the reader will come to appreciate the importance of optical solitons and other related optical devices in future communication systems. We acknowledge with thanks the editorial help of Dr. Angela Lahee, Editor, Springer-Verlag.

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