Preface

In the 21st Century, information technology will be essential for realizing a worldwide 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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Pondicherry and Kochi — K. Porsezian
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List of Contributors

M.J. Ablowitz
Department of Applied Mathematics
University of Colorado at Boulder
Boulder, CO 80309-0526, USA
Mark.Ablowitz@colorado.edu

A.B. Aceves
Department of Mathematics and Statistics
University of New Mexico
Albuquerque, NM 87131
aceves@math.unm.edu

N.N. Akhmediev
Optical Sciences Centre
Research School of Physical Sciences and Engineering
Institute of Advanced Studies
Australian National University
Canberra, ACT 0200, Australia
nna124@rsphy1.anu.edu.au

A. Ankiewicz
Optical Sciences Centre
Research School of Physical Sciences and Engineering
Institute of Advanced Studies
Australian National University
Canberra, ACT 0200, Australia
ana124@rsphysse.anu.edu.au

K.J. Blow
Aston University
Aston Triangle
Birmingham, B4 7ET,UK
k.j.blow@aston.ac.uk

C. Conti
INFM-RM3, Via della
Vasca Navale 84, 00146 Roma, Italy
c.conti@ele.uniroma3.it

J.I. Dijkhuis
Atom Optics and Ultrafast Dynamics
Debye Institute, University of Utrecht
P.O. Box 80 000, 3508 TA
Utrecht, Netherlands
J.I.Dijkhuis@phys.uu.nl

P.T. Dinda
Laboratoire de Physique
de l'Université de Bourgogne
UMR CNRS No. 5027, Av.A. Savary
B.P. 47 870, 21078 Dijon Cédex,
France
Patrice.Tchofo-Dinda
@u-bourgogne.fr

J.M. Dudley
Laboratoire d'Optique P.M. Duffieux
Université de Franche-Comté, 25030
Besançon, France
john.dudley@univ-fcomte.fr

M. Haelterman
Service d'Optique et Acoustique
Université Libre de Bruxelles, B-1050
Bruxelles, Belgium
Marc.Haelterman@ulb.ac.be

A. Hasegawa
Himeji Dokkyo University
and Soliton Communications
43, 19-1 Awataguchi Sanjobocho
Higashiyama, Japan
soliton@mbox.kyoto-inet.or.jp

J. Herrmann
Max Born Institute for Nonlinear
Optics and Short Pulse Spectroscopy
Max-Born-Str. 2a, D-12489 Berlin
Germany
jherrman@mbi-berlin.de

T. Hirooka
Department of Applied Mathematics
University of Colorado at Boulder
Boulder, CO 80309-0526, USA
hirooka@riec.tohoku.ac.jp

A. Husakou
Max Born Institute for Nonlinear
Optics and Short Pulse Spectroscopy
Max-Born-Str. 2a, D-12489 Berlin
Germany
gusakov@mbi-berlin.de

T. Inoue
Graduate School of Engineering Osaka
University
2-1 Yamada-oka, Suita, Osaka
565-0871, Japan
inoue@comf5.comm.eng.
osaka-u.ac.jp

V.P. Kalosha
Max Born Institute for Nonlinear
Optics and Short Pulse Spectroscopy
Max-Born-Str. 2a, D-12489 Berlin
Germany
kalosha@mbi-berlin.de

T. Kanna
Centre for Nonlinear Dynamics
Department of Physics
Bharathidasan University
Tiruchirapalli 620 024, India
tkans@yahoo.com

V.C. Kuriakose
Department of Physics
Cochin University of Science and
Technology, Kochi-682 022, India
vck@cusat.ac.in

A. Labruyere
Laboratoire de physique
de l'Université de Bourgogne
UMR CNRS No. 5027, Av.A. Savary
B.P. 47 870, 21078 Dijon
Cédex, France
lbruyere@u-bourgogne.fr

M. Lakshmanan
Centre for Nonlinear Dynamics
Department of Physics
Bharathidasan University
Tiruchirapalli 620 024, India
lakshman25@satyam.net.in

S.B. Leble
Faculty of Applied Physics and
Mathematics, Technical University
of Gdansk ul G Narutowicza, 11/12
80-952 Gdansk-Wrzeszcz, Poland
lleble@mif.pg.gda.pl

A. Maruta
Graduate School of Engineering
Osaka University
2-1 Yamada-oka, Suita
Osaka, 565-0871, Japan
maruta@comm.eng.osaka-u.ac.jp

G. Millot
Laboratoire de Physique
de l'Université de Bourgogne
21078 Dijon, France
Guy.Millot@u-bourgogne.fr

C. Montes
Centre National
de la Recherche Scientifique
Laboratoire de Physique
de la Matière Condensée
Université de Nice - Sophia Antipolis
Parc Valrose
06108 Nice Cedex 2, France
montes@unice.fr

O.L. Muskens
Atom Optics and Ultrafast Dynamics
Debye Institute, University of Utrecht
P.O. Box 80 000, 3508 TA
Utrecht, Netherlands
O.L.Muskens@phys.uu.nl

K. Nakkeeran
Laboratoire de physique
de l'Université de Bourgogne
UMR CNRS No. 5027, Av.A. Savary
B.P. 47 870, 21078 Dijon
Cédex, France
ennaks@polyu.edu.hk

Y. Nonaka
Graduate School of Engineering
Osaka University
2-1 Yamada-oka, Suita
Osaka, 565-0871, Japan
nonaka@comf5.comm.eng.
osaka-u.ac.jp

S. Pitois
Laboratoire de Physique
de l'Université de Bourgogne
21078 Dijon, France
Stephane.Pitois@u-bourgogne.fr

K. Porsezian
Raman School of Physics
Pondicherry University
Pondicherry-605 014, India
ponzsol@yahoo.com

J.M. Soto-Crespo
Instituto de Optica, Consejo Superior
de Investigaciones Cientificas,
Serrano 121
28006 Madrid, Spain
iodsc09@io.cfmac.csic.es

V.B. Taranenko
Physikalisch-Technische
Bundesanstalt
38116 Braunschweig
Germany
Victor.Taranenko@ptb.de

K. Thyagarajan
Physics Department
Indian Institute of Technology
New Delhi 110016, India
ktrajan@physics.iitd.ernet.in

G.E. Town
Department of Electronics
Macquarie University
NSW 2109, Australia
gtown@ics.mq.edu.au

S. Trillo
University of Ferrara, Via Saragat 1
44100 Ferrara, Italy
strillo@fub.it

C.O. Weiss
Physikalisch-Technische
Bundesanstalt
38116 Braunschweig, Germany
Carl.Weiss@ptb.de

Y. Yoshika
Graduate School of Engineering
Osaka University
2-1 Yamada-oka, Suita
Osaka, 565-0871, Japan
yoshika@comf5.comm.eng.
osaka-u.ac.jp