Tunable Micro-optics

Presenting state-of-the-art research into the dynamic field of tunable micro-optics, this is the first book to provide a comprehensive survey covering a varied range of topics including novel materials, actuation concepts, and new imaging systems in optics. Internationally renowned researchers present a diverse range of chapters on cutting-edge materials, devices, and subsystems, including soft matter, artificial muscles, tunable lenses and apertures, photonic crystals, and complete tunable imagers. Special contributions also provide in-depth treatment of micro-optical characterization, scanners, and the use of natural eye models as inspiration for new concepts in advanced optics. With applications extending from medical diagnosis to fiber telecommunications, *Tunable Micro-optics* equips readers with a solid understanding of the broader technical context through its interdisciplinary approach to the realization of new types of optical systems. This is an essential resource for engineers in industry and academia, and advanced students working on optical systems design.

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Frontmatter
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We thank our families for putting up with all the nonsense that kept us busy throughout this project. You guys always put our focus right.

Thomas, Helen and Nele,

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Acronyms

2D	two-dimensional
3D	three-dimensional
AA	acrylic acid
AC	alternating current
AFM	atomic force microscope
AlN	aluminum nitride
AOSLO	adaptive optics scanning laser ophthalmoscope
ARC	anti-reflective coating
BHF	buffered hydrofluoric acid
BLU	backlighting unit
BOX	buried oxide
CAD	computer aided design
CASSI	coded aperture snapshot spectral imager
CCD	charged-coupled device
CE	counter electrode
CMOS	complementary metal oxide silicon
CT	computerized tomography
CTE	coefficient of thermal expansion
CTIS	computed tomography imaging spectrometer
CVD	chemical vapor deposition
DBR	distributed Bragg reflector
DC	direct current
DEFOC	defocus
DI	de-ionized (water)
DLL	dielectric liquid lens
DMAEMA	2-dimethylaminoethyl methacrylate
DMD	digital mirror device
DNA	deoxyribonucleic acid
DOE	diffractive optical elements
DOF	depth of field
DRIE	deep reactive ion etching
EAP	electroactive polymer
EC	electrochromic

ECX	equiconvex
EM	electromagnetic
EWOD	electrowetting-on-dielectrics
FIB	focused ion beam
FCC	face centered cubic
FD-OCT	Fourier-domain OCT
FEM	finite element method
FLC	ferroelectric liquid crystal
FOV	field of view
FP	Fabry-Pérot (interferometer)
FWHM	full width at half maximum
GLV	grating light valve
GO-GMA	glycidylmethacrylate-functionalized graphene oxide
GRIN	graded index
HCP	hexagonal close-packed
IC	integrated circuit
IFT	interfacial tension
IHTFP	rude MIT colloquialism
IOL	intra-ocular lens
IPA	isopropyl alcohol
IR	infrared
ITO	indium tin oxide
I2C	inter-integrated circuit
LC	liquid crystal
LCA	longitudinal chromatic aberration
LCD	liquid crystal display
LCE	liquid crystal elastomer
LCOS-SLM	liquid crystal on silicon spatial light modulators
LDV	laser Doppler vibrometry
LED	light emitting diodes
LOC	lab-on-a-chip
LPCVD	low pressure chemical vapor deposition
LTCC	low temperature cofired ceramics
MEMS	micro-electro-mechanical systems
MOVPE	metal-organic vapor-phase epitaxy
MTF	modulation transfer function
MZ	Mach-Zehnder (interferometer)
NA	numerical aperture
NCD	nanocrystalline diamond
NIPAAm	N-isopropylacrylamide
NMR	nuclear magnetic resonance
OASLM	optically addressed spatial light modulators
OCT	optical coherence tomography
OLED	organic light emitting diodes

OT	optical transmission
OTF	optical transfer function
PAC	photo addressable cell
PBS	polarizing beam splitter
PC	polycarbonate
PCB	printed circuit board
PDMS	polydimethylsiloxane
PEDOT	poly-3, 4-ethylenedioxythiophene
PEEK	polyetheretherketone
PLA	polylactic acid
PMMA	polymethylmethacrylate
PNIPAAm	poly(N-isopropylacrylamide)
PSF	point spread function
PSI	phase shifting interferometry
PV	peak-valley
PZT	lead zirconate titanate
R&D	research and development
RCWA	rigorous coupled wave analysis
RIE	reactive ion etching
RMS	root mean square
ROC	radius of curvature
RPG	resonant periodic gain
SA	spherical aberration
SAM	self-assembled monolayers
SD-OCT	spectral-domain OCT
SEM	scanning electron microscope
SLM	spatial light modulators
SMA	shape-memory alloy
SOA	semiconductor optical amplifier
SOI	silicon-on-insulator
SS-OCT	swept-source OCT
SXGA	super extended graphics array
μTAS	micro total analysis system
TCL	three-phase contact line
TCO	transparent conductive oxide
TD-OCT	time-domain OCT
TE	transverse electric
TF	tetrafoil
THF	tetrahydrofuran
TM	transverse magnetic
TMAH	tetra-methyl ammonium hydroxide
TOC	thermo-optic coefficient
USB	universal serial bus
UV	ultraviolet

VB	valence band
VASE	variable angle spectral ellipsometry
VCM	voice coil motors
VCSEL	vertical-cavity surface-emitting laser
VOA	variable optical attenuators
VDM	wavelength division multiplex
WE	working electrode
WLI	white light interferometry
WLIM	white light interference microscopy