

Index

a

- absorbing polarizer 13, 14
- acoustic wave device 338, 339
- acousto-optic beam deflector (AOBD)
 - 68–73
 - applications 73
 - cylinder lensing effect 72
 - modulation transfer function 71–72
 - optical deflector resolution 70–71
 - scan fly back time 72
 - schematic setup of 70
- acousto-optic frequency shifter 73–76
 - double pass 75
 - laser Doppler vibrometer 75–76
 - low frequency shifts 75
 - operation principles 73–75
- acousto-optic materials 51, 53, 54, 64, 68, 124–134
 - leadmolybdate 125
 - lithium niobate 131–134
 - requirements 125
 - tellurium dioxide 125–131
- acousto-optic modulator (AOM)
 - 59–69, 75, 78, 79, 118, 121, 129–131
 - analog modulation 66–67
 - applications of 68–69
 - construction 64–65
 - defined 63–64
 - digital modulation 65–66
 - dynamic contrast ratio 67
 - non-resonant 64
 - two-channel 68, 69
- acousto-optic super-lattice modulation (AOSLM) 80, 81
- acousto-optic tunable filters (AOTFs)
 - 63, 83–124, 126, 127, 132, 133
 - advantages 88
 - autonomous tunable filter system 101–106
 - description 83
 - detectors for HPLC 106–109
 - infrared multispectral imaging 86–88
 - IR spectrometers 112–121
 - calibration target 120–121
 - electronics box (EB) 119–120
 - environmental requirements and characterization 121
 - instrument concept 115–116
 - optical box 116–120
 - multidimensional fluorimeter 90–93
 - multiwavelength thermal lens spectrometer 94
 - near infra-red (NIR)
 - spectrophotometer 95–98
 - NIR detector for FIA 109–112
 - NIR spectropolarimeter 98–101
 - non-collinear design 84
 - operation principles 83–86
 - satellite and space-based applications 112–124
- acousto-optical Q-switch 76–83
 - applications 77–83
 - schematic representation of 77

- acousto-optics 59–134, 434, 437
 acousto-optic effect, principle of
 61–62
 defined 59
 history of 59–61
 activation loss (AL) 335
 all-fiber sensors 207–209
 anisotropic medium 1, 7, 84, 277
 anti-ferromagnetic materials 149, 150,
 160
 antiferromagnetic compounds
 159–161
 antiferromagnetic spintronics 160
 anti-ferromagnets 149, 150, 159–161,
 235
 appropriate insulation (MV) 323
 artificial path difference 270
 atomic theory, of photoelasticity
 33–35
 autocorrelation technique 453
 autonomoustunable filter system,
 AOTF-based 101–106
 auxiliary controller 119
- b**
- barium strontium titanate $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$
 (BST) 266, 268, 327–328
 barium titanate (BaTiO_3) 288, 359
 crystals 266
 high transmittance 288–289
 light phase modulator 266
 plasmonic interferometer 292–293
 waveguide electro-optic modulator
 289–292
 biaxial crystals 2, 3
 wave surface for 5, 6
 bi-material notches 50
 binary phase shift keying (BPSK) 304
 birefringence 1, 6–8, 14, 15, 17, 27–29,
 35, 36, 45, 51, 121, 132, 143, 147,
 153–155, 158, 159, 161, 170, 191,
 208, 209, 211, 218, 265, 268, 274,
 275, 328, 329, 423, 446, 462, 463
 birefringent 6, 7, 15, 19, 27, 28, 45, 83,
 86, 99, 127, 145, 265, 274, 329
 birefringent LiNbO_3 electro-optic
 waveguide (BEOW) 320
 birefringent materials 6, 15
 birefringent wave plate 14–16, 19
 bismuth ferrite 359
 bismuth silicon oxide, $\text{Bi}_{12}\text{SiO}_{20}$ (BSO)
 287, 449
 Bragg cells 63, 73, 75, 76
 Bragg diffraction 59, 61–63, 116
 Brewster, D. Sir 27–29
 Brewster constant 28
 Brewster's angle 17
 broadband optical isolator 22
 buffer layer deposition 301
 bulk optic sensors 207, 209–211
- c**
- carbonates 112, 114
 cavity dumper 68
 centre aperture detection (CAD) 240
 cerium-doped BaTiO_3 photorefractive
 crystal, fast switching of
 440–444
 chemical solution deposition (CSD)
 340
 circular magnetic birefringence (CMB)
 147
 circular magnetic dichroism (CMD)
 149
 circular polarization 12, 15, 22, 145
 CMOS-compatibility 367–368
 coherence gated holographic imaging
 455–457
 coherent receiver 268, 304–305
 common path interferometer (CPI)
 315
 compact disk rewritable (CD-RW) 219
 complementary metal–oxide–
 semiconductor (CMOS) 157,
 310, 355, 367, 368
 compatibility 367–368
 computer generated holograms (CGHs)
 453
 coplanar-waveguide (CPW) 304
 Cotton–Mouton effect 144, 147, 148
 coupler interferometer (CI) 314–315
 critical angle, of material 7
 crystal optics, defined 1
 crystal symmetry, effect of 3–4

d

- DEMON 424
- dense wavelength division multiplexing (DWDM) 329, 332, 334, 432, 470–472, 474
- Detector's preamplifier 116
- dichroism 20, 153–155, 170, 171, 218
- differential group delay (DGD) 334
- digital direct synthesizers (DDS) 103, 104
- diode array detectors (DADs) 106, 108, 109
- direct fringe writing process 453
- directional couplers 132, 200, 201, 282–285, 363, 467
- domain wall displacement detection (DWDD) 241, 242
- Doppler shift 73, 75, 76
- double refraction 1, 3, 6, 7, 20, 28, 30, 281, 282
- dynamic contrast ratio (DCR) 67
- dynamic gain flattening filters (DGFF) 335–338
- dynamic photoelasticity 29, 50
- dynamic polarization controller 334, 335
- dynamic wave retarder 277–278

e

- Eclipse™ VOA device 333
- elasto-optic coefficients (EOCs) 32, 52, 61
- elasto-optic effect 83, 275
- electrically switchable cylindrical Fresnel lens 460–467
- electric field sensors 268, 310, 316, 320
- electro-optic (EO) 269–371
 - lens 295
 - tuning 307, 323, 324, 327
- electron beam lithography 199, 306
- electronics box (EB) 112, 115, 116, 119, 120
- electro-optical plasmonic modulators 270
- electro-optic deflector (EOD) 340, 347–350

- electro-optic devices 266, 268, 275–288
 - directional couplers 282–285
 - dynamic wave retarder 277–278
 - intensity modulators (type 1) 278–279
 - intensity modulators (type 2) 279–280
 - phase modulator 275–276
 - PROM 287–288
 - scanners 280–282
 - spatial light modulators (electrically addressed) 285
 - spatial light modulators (optically addressed) 285–287
- electro-optic directional coupler 283, 284
- electro-optic effects 265–275, 283, 285, 287, 289, 293, 299, 311, 316, 328, 329, 335, 347, 348, 411, 415, 419, 422, 427, 429, 434, 445
- electro-optic devices
 - directional couplers 282–285
 - dynamic wave retarder 277–278
 - intensity modulators (type 1) 278–279
 - intensity modulators (type 2) 279–280
 - phase modulator 275–276
 - PROM 287–288
 - scanners 280–282
 - spatial light modulators (electrically addressed) 285
 - spatial light modulators (optically addressed) 285–287
- history 265–270
- phenomenological theory
 - linear electro-optic effect 272–274
 - quadratic electro-optic effect 274–275
- principles 270–271
- electro-optic materials and applications 288–354
 - BaTiO₃ 288–293
 - LiTaO₃ 295–298
 - SHG 295–298

- electro-optic materials and applications (*contd.*)
- PLZT 293–295
 - electro-optictunable etalon 294
 - electro-optic medium, refractive index of 270
 - electro-optic modulators 38, 266, 268, 269, 276, 285, 286, 288, 291, 292, 310, 311, 328, 338, 340
 - electro-optic phase retardation device 266, 293
 - electro-optic plasmonic materials and applications 354–371
 - CMOS-compatibility 367–369
 - silicon waveguide-based modulators 364–368
 - transparent conducting oxides 360–363
 - ultra-compactplasmonic modulators 362–364
 - electro-optic prism 281
 - electro-optic Q-switching 37, 330–332
 - electro-optic scanner 295
 - electro-optic tunable filter 329–330
 - elliptical polarization 12–13
 - E-O modulators 301, 340
 - epsilon-near-zero (ENZ) 356, 357, 366, 367
 - equatorial Kerr effect 149
 - EquinoxTM 336, 337
 - erbium-doped fiber (EDF) 80
 - erbium doped fiber amplifier (EDFA)
 - based NIR spectrophotometer 95–98
 - erbium-doped fiber amplifiers (EDFAs) 89, 96, 332
 - EuSe magneto-optic modulator 169
 - ExoMars rover 112, 113, 121
 - extinction ratio (ER) 132, 154, 280, 307–309, 316, 358, 459
 - extraordinary ray 5, 7, 8, 84, 125
 - extraordinary wave surface 4
- f**
- fabricated electrical contacts 307
 - fabricated optical devices 307
 - false-color scanning electron microscope (SEM) 307
 - Faraday effect 143–147, 149, 152, 161, 166–168, 170, 186, 191, 192, 206, 218
 - Faraday rotation 36, 146, 147, 150, 151, 154, 155, 158–161, 163–167, 169, 174, 177, 191, 192, 197, 198, 227
 - fast inter-band photorefractive effect 434
 - fast varifocal lenses 346–347
 - femtosecond pulses 268, 299
 - ferrimagnetic compounds 156–159
 - ferrimagnetic garnet oxide crystals 191
 - ferrimagnetic materials 149–151
 - ferrimagnetic RE–TM films 228, 229
 - ferrites 150, 152, 164, 179–183, 185, 189, 214
 - ferroelectric crystals 54, 55, 274, 295, 426
 - ferroelectric memory (FRAM) 119
 - ferrofluids 153, 155, 156, 175, 176
 - ferromagnetic HgCdCr₂Se₄
 - semiconductor, magneto-optical response of 153
 - ferromagnetic materials 149–151, 160, 211
 - ferromagnetic semiconductors 152–153
 - fiber Bragg grating (FBG), acousto-optic interaction 78–82
 - long-wavelength regime 79
 - short-wavelength regime 80–82
 - fiber laser, with SCPEM Q-switch 38, 39
 - fiber-optic collimators 294
 - fiber optics gyroscopes (FOGs) 301
 - field-induced electrostriction strain 275
 - field of view (FOV) 112, 114–116, 122, 123, 129, 131, 345–346, 457
 - film-loaded surface acoustic wave guide 132
 - finite element method (FEM) 29, 176–178, 181, 343, 346, 363

flow injection analysis (FIA) 89,
109–112
fluorescence loss in photobleaching
(FLIP) technique 93
fluorescence technique 93
focused ion beam (FIB) 292, 323–325
free-space optical (FSO) communication
301
free-space optical isolator design 191
free spectral range (FSR) 294, 325, 330,
336, 337
freestanding microdisk 325
Fresnel reflection 16, 17, 435
Fresnel zone plates 461, 463, 464

g

gallium 64, 152, 199, 359
germanium 64, 82, 359
Glan–Thompson prism 20, 21
gold electrodes 292, 313, 344, 449
gyrotropic permittivity 143–144

h

half wave electric field 313, 321
half-wave plate 21–23, 347
half-wave voltage 275–277, 281, 290,
307, 308, 316
harmonic frequency 336
high-density MO recording 239–245
 hybrid recording 244–245
 near-field recording 244
 recording density 242–244
 resolution of optical readout
 239–242
high-resolution camera (HRC) 112,
114
high-resolution color camera (HRC)
113
high-speed optical modulators 340
Holman's device-level analysis 269,
338
holographic data storage 409, 419,
423–425
holographic displays 452–453
holographic interferometry techniques
444–451
 advantages 445

 phase-shifting 446
 real-time holographic interferometry
 446, 447
holographic optical coherence imaging
455–457
holographic polymer dispersed liquid
crystal (H-PDLC) 423,
457–467
 electrically switchable cylindrical
 Fresnel lens 460–467
 wavelength switch 458–460
Huth's equation 221, 239
hybrid recording technique 244–246
hydrated/hydroxylated salts 114
hydrofluoric (HF) 325

i

index ellipsoid 1–3, 7, 30, 31, 271–273
indium phosphide 306, 359
indium tin oxide (ITO) 323, 330, 355,
356, 358, 359, 362–364, 367, 371,
440, 458, 462
infrared (IR) 64, 295, 327, 426
 spectrometer 113
 multispectral imaging 86–88, 90
 reflectance spectroscopy 114, 121
Infrared Spectrometer for ExoMars
(ISEM) 112–121
insertion loss (IL) 157, 181–183, 189,
201, 202, 294, 304, 306, 316, 330,
333–337, 366, 369, 458–460, 474
integrated combiner modules 473
integrated optical electric field sensor
(IOES) 314–316, 319, 323
integrated optical phase modulator
277
integrated-optic directional couplers
283, 284
integrated optics 197, 266, 288, 295,
320–323, 340, 367
integrated optoelectronic devices
339
integrated plasmonic circuits 269, 355
intensity-modulation-type modulators
154
intensity modulators (type 1) 278–279
intensity modulators (type 2) 279–280

inter-band photorefractive effect
417–418, 422, 434, 435, 439
interference filters 18, 63, 94, 95
iron-doped LiNbO_3 425

k

Kerr coefficient 268, 271, 328
Kerr effect 148, 149, 151, 152, 194,
195, 225, 226, 234, 247, 265, 266,
270, 274, 327, 328, 348, 349
Kerr electro-optic birefringence 265,
274
Kerr electro-optic effect 148, 265,
274
Kerr ellipticity 144–145
Kerr medium 271
Kerr rotation 144–145, 149, 159, 226,
227, 232, 233
Klein–Cook parameter 62
 KNbO_3 , electro-optic properties of
269

l

lanthanum (La) 293
laser Doppler vibrometer (LDV)
75–76
laser power modulation (LPM) process
222–224, 239
laser ultrasound 454
law of reflection 16
lead lanthanum zirconate titanate
(PLZT) 266, 268, 269, 293–295,
328, 338
electro-optic tunable etalon 294
lead magnesium niobate-lead titanate
(PMN–PT) 266, 268–269,
328–338
electro-optic Q-switching 330–332
electro-optic tunable filter 329–330
PC 334–335
VOA 332–334
lead molybdate (PbMoO_4) crystal 125,
126
light polarizing devices 20–24
optical attenuators 22–23
optical isolator 22
phase plate 21–22
polarization rotator 23–24
polarizing plate 20
polarizing prism 20–21
 LiNbO_3 crystals 41, 42, 51–53, 298,
303, 316, 321, 348, 428, 429, 439
electro-optic field sensors 310–323
nanophotonic modulator 306–310
 LiNbO_3 microresonator 323–327
linear birefringence 153, 208, 209, 211
linear electro-optic coefficient 271
linear electro-optic constants 272
linear electro-optic effect 265, 266,
270–274, 415, 429, 434, 445
primary effect 273
secondary effect 273
linear magnetic birefringence (LMB)
147
linear magnetic dichroism (LMD) 149
linear polarization 10–11, 13, 15, 24
equal amplitudes 10, 13
unequal amplitudes 10–11, 13
linear polarizer 13, 22, 161, 162
liquid crystal twisted nematic
polarization rotator cell 24
lithium heptagermanate ($\text{Li}_2\text{Ge}_7\text{O}_{15}$)
crystals 53–55
lithium niobate (LiNbO_3) 51, 64,
131–134, 268, 295, 298–327, 412,
425, 433
application 299–327
balanced 90° coherent receiver
304–305
quadrature modulator 303–304
space environment 301–303
modulators 300
polarization beam splitter 132
surface acoustic wave guide
132–133
waveguide reflector 133–134
lithium niobate (LN) crystal 348, 425
of Q factors 323
lithium tantalate (LiTaO_3) 295–298
EO lens 295–298
EO scanner 295–298
SHG 295–298
local oscillator (LO) laser 304
long persistence holograms 452

low-loss waveguide 298, 310, 370
 Lunar infrared spectrometer (LIS) 113

m

Mach-Zehnder electro-optic modulators 268, 328
 Mach-Zehnder interferometer (MZI) 278, 300, 319
 Mach-Zehnder magneto-optic (MO) modulator 166
 Mach-Zehnder modulators 169, 289, 313
 Mach-Zehnder optical waveguide interferometer 289, 316
 magnetic amplifying magneto optical system (MAMMOS) 241
 magnetic field-measurement systems 205
 magnetic field modulation (MFM) process 222, 224–225, 240
 magnetic fluid (MF) 152–156, 218–219
 birefringence effect 155
 description 153
 dielectric constant/refractive index of 155
 properties 154
 magnetic fluid based magneto-optic modulator 170–174
 magnetic fluid-based modulator applications 154
 magnetic fluid sensor 218–219
 magnetic force sensors 207, 211–219
 magnetic fluid sensor 218–219
 magnetostrictive sensors 212–215
 Terfenol-D sensors 215–218
 magnetic memory chips (MRAMs) 160
 magnetic super resolution (MSR) 234, 240, 242
 magneto-optical (MO) circulators 177–190
 multiple-port integrated optical circulators 186–189
 tetrahertz 189–190
 T-shaped 177–186
 magneto-optical isolators 190–205

nonreciprocal phase-shift isolator 193–197
 QPM Faraday rotation isolator 192–193
 silicon-based MO isolator and circulator 197–201
 THz isolators 201–205
 TM-mode waveguide isolators 194–204
 magneto-optical recording 219–247
 high-density 239–245
 laser power modulation process 222–224
 magnetic field modulation 224–225
 principles of 220–222
 readout 225–226
 ultrahigh-density 245–247
 magneto-optical recording materials 227
 characteristics 227
 exchange coupled films 233–236
 magnetic film properties 226
 metallic multilayers 236–239
 RE–TM amorphous alloy films 228–233
 magneto-optical sensors 205–219
 all-fiber sensors 207–209
 bulk optic sensors 209–211
 magnetic force sensors 211–219
 magneto-optic effect 143, 145, 147–149, 157, 159, 161, 191, 197, 198
 absorption mode 149
 reflection mode 148–149
 of RE–TM films 232
 transmission mode 145–148
 magneto-optic Kerr effect (MOKE) 143, 151–153, 159, 225, 226, 233, 238
 in bilayer MnPSe_3 159
 high temperature noncollinear antiferromagnets 159
 magneto-optic modulator 161–177
 Mach-Zehnder magneto-optic modulator 166–169
 magneto-optic spatial light modulator 161–166

- magneto-optic spatial light modulator (MOSLM) 161–166
 - magneto-photonic crystal (MPC)
 - circulators 178, 181
 - magneto-resistive field sensors 206
 - magnetostrictive sensors 212–215
 - magnetron sputtering 216, 340
 - main controller (MC) 118
 - mast-mounted optical box (OB) 115
 - metal–insulator–metal (MIM) 360, 362–364, 368, 370
 - metal/magneto-optic plasmonic lens (MMOPL) 202–204
 - metal/MO plasmonic waveguide (MMOPW) 201, 202
 - metal organic chemical vapor deposition (MOCVD) 290, 339, 340
 - metal–oxide–semiconductor (MOS) 358, 365
 - Michelson *vs.* photorefractive crystal interferometer 449, 450
 - MicrOmega 114, 115
 - microresonators 268, 323–327
 - Mn-doped III–V semiconductors, ferromagnetism in 152
 - MO disk 219, 228
 - mode locker 68, 81, 82
 - modulation transfer function (MTF)
 - model 66, 67, 71–72
 - monochromatic optical isolator 22
 - mono-shielding electrode 313, 314
 - Morin transition 160
 - Muller, H. 33, 35
 - multicolour holographic stereograms 453
 - multiple-port integrated optical circulators 186–189
- n**
- nanoelectromechanical systems (NEMS) 339
 - nanoelectronics 371
 - nanophotonic 293, 306–310, 355, 365, 370, 371
 - nanophotonic LiNbO₃ modulator 306–310
 - nano-second speed PLZT optical switch 294–295
 - narrow-band continuous-wave tunable diode laser 325
 - narrow band hyper spectral systems 101
 - navigation cameras (NavCam) 113
 - near-field recording technique 244
 - near infra-red (NIR) spectrophotometer, AOTF-based 95–98
 - negative uniaxial medium wave surface 5
 - Nelder–Mead optimization method 182
 - nematic liquid crystals 270
 - Nicol prism 20, 21
 - NIR spectropolarimeter, AOTF based 98–101
 - nonlinear optical applications 266, 288, 340, 425
 - nonlinear optical coefficients 269, 338
 - nonreciprocal-loss isolator 191
 - 1.5- μm nonreciprocal-loss waveguide optical isolator 152
 - nonreciprocal phase-shift isolator 191–193
 - non-resonant acousto-optic modulator 64
 - non-return-to-zero (NRZ) 309
- o**
- onboard computer (OBC) controls 120
 - on-chip electro-optic tunable LN microresonator 324
 - optical attenuators 22–23
 - optical beam scanner 344, 350–354
 - optical box (OB) 115, 116, 118, 119
 - optical circulator 80, 157, 177, 178, 186, 187, 198
 - features 177
 - magneto-optical 177–190
 - three-port 178, 179
 - optical filters 18, 19, 118, 327, 329, 432, 433, 438
 - optical indicatrix 1–3, 31, 61
 - optically induced waveguides 426

- optical isolator 22, 143, 151, 152, 157, 158, 190, 191, 193, 195, 198–200
 - optical parametric oscillation 269, 338
 - optical powers 63, 214, 219, 278, 282–284, 313, 322, 325, 332
 - optical recording media 219
 - optical switching device 266, 288, 290, 339
 - optical waveguides 266, 268, 269, 279, 288, 299, 307, 308, 319, 321, 328, 338–340, 343, 344, 425
 - optic axis 2, 3, 6, 7, 127, 222, 299
 - opto-ceramic harmonic elements 336
 - opto-ceramic (OC) materials 332, 335
 - opto-ceramic Q-switches 331
 - ordinary ray 5, 7, 84
 - ordinary wave surface 4
- p**
- Panoramic camera (PanCam) 112–115, 120, 121
 - Peltier-cooled InAs detector 112
 - perovskite–structure material 338
 - phase-modulation-type modulators 154
 - phase plate 21–22
 - phase-shifting 193, 446
 - phase-stepping technique 446
 - phenomenological theory, of
 - photoelasticity 30–33
 - photoelastic accelerometer 41–45
 - photoelastic devices 35–50
 - photoelastic force sensor 45–50
 - photoelasticity 1, 27–55, 61, 273
 - atomic theory 33–35
 - defined 27
 - history of 28–30
 - phenomenological theory 30–33
 - principle of 27–28
 - photoelastic modulator (PEM) 36–38, 51
 - photoelastic path difference 270
 - photoelastic Q-switch 38–41
 - photopolymers 423–425, 451, 457
 - coherence gated holographic imaging 455–457
 - holographic autocorrelator 453–454
 - holographic displays 452–454
 - laser ultrasonic receiver 454
 - surface waveguide 457
 - ultrasound-modulated optical tomography 454–455
 - photorefractive damage threshold 299
 - photorefractive effect 409–475
 - band diagram behaviour 410
 - change of refractive index 411
 - charge transport 410–411
 - conventional model of 412–413
 - disadvantage 440
 - in electro-optic crystals 422
 - features 419
 - generation of charge carriers 410
 - holographic data storage 419–420
 - inter-band 417–418
 - light induced waveguides 421–422
 - photorefractive index gratings 413–415
 - space charge field, for sinusoidal illumination 415–416
 - trapping of mobile carriers 411
 - two waves mixing/two beam coupling 420–421
 - photorefractive index gratings 413–415
 - photorefractive information storage materials (PRISM) 424
 - photorefractive sensitivity 269, 338
 - photorefractive switches 439–444
 - photorefractive tunable filters 432–439
 - photorefractive waveguides 425–432
 - photosensitive glass 423, 467–473
 - photosensitive materials, requirements for 468
 - piezo-optic coefficients (POCs) 51, 52, 54, 55
 - planar waveguide fabrication, in $\text{Sn}_2\text{P}_2\text{S}_6$ crystals 426
 - planar waveguides 282, 295, 296, 426, 428
 - plane of incidence 5, 16, 19, 457

- plasmonics 201–204, 269, 354, 370
 - interferometer 266, 292–293
 - modulators 293, 358, 359, 363, 364, 366, 369, 371
 - plasmon-mediated transmission 293
 - PLZT ceramic element 266, 293
 - PLZT optical switch subsystem 294
 - Pockels coefficient 271, 277, 283
 - Pockels effect 144, 265, 270, 274, 277, 287, 326, 347–349, 415, 424, 439, 441, 442, 445
 - Pockels effect index modulation 270
 - Pockels electro-optic constants 272
 - Pockels medium 271
 - pockels readout optical modulator (PROM) 287–288
 - Pockels theory 31
 - Poincare sphere 334, 335
 - polarisation-dependent loss (PDL) 333–335, 341
 - polarization controller (PC) 163, 164, 269, 316, 325, 334–336
 - polarization dependent loss (PDL) 333–335, 341
 - polarization maintaining optical fibers (PMF) 154, 304, 321
 - polarization mode dispersion (PMD) 334
 - polarization of light 1, 8–16, 20, 36, 38, 161, 191
 - birefringent wave plate 14–16
 - circular polarization 11–12
 - elliptical polarization 12–13
 - linear polarization 10–11
 - polarizer and polarizing beam splitters 13–14
 - reflected and transmitted
 - at an interface between two media 16–17
 - at multilayer thin film coatings 17–20
 - polarization rotator 23–24, 192
 - polarizers 13, 14, 19, 22, 24, 27, 116, 191, 279, 280, 285, 329, 341, 447, 464, 465
 - polarizing plate 20, 21
 - polarizing prism 20–21
 - Polaroid “H-Sheet” 14
 - positive uniaxial medium wave surface 5
 - potassium dihydrogen arsenate (KDA) 266
 - potassium dihydrogen phosphate (KDP) 266
 - potassium niobate (KNbO_3) 269, 338–339, 412
 - potassium tantalate niobate ($\text{KTa}_{1-x}\text{Nb}_x\text{O}_3$) 348
 - potassium tantalate niobate (KTN) 266, 339–354
 - crystals 269
 - electro-optic phase modulator 340–346
 - EOD 347–351
 - fast varifocal lenses 346–347
 - optical beam scanner 350–354
 - potassium tanta optical beam scanner 353
 - power supply unit (PSU) 119
 - power-transfer ratio 282, 283
 - primary effect 273
 - primary optic axes 3, 4
 - proton exchange (PE) 132, 268, 295, 298
 - Pt/Co multilayers 238
 - pulsed laser deposition (PLD) 289, 339, 340
 - “push–pull” modulators 303
- q**
- Q-switched diode pumped solid-state (DPSS) 331
 - Q-switches 63, 74, 268, 331, 332, 346
 - Q-switching 38, 51, 59, 78–83, 299, 330, 331
 - acousto-optic modulation 78–79
 - distributed feedback-fiber laser setup 82–83
 - FBG, acousto-optic interaction 79
 - mode-locking regime 80–82
 - quadratic electro-optic coefficient 274
 - quadratic electro-optic effect (QEO effect) 265, 270, 274–275, 339, 348

- quadrature phase shift keying (QPSK) 303, 304
- quarter-wave plate 15, 21, 22
- quartz 6, 22, 36, 50, 64, 76, 86, 88, 99, 265, 270
- quartz retardation plates 24
- quasi-phase matching (QPM)
Faraday rotation isolator 191–193
principle 299
- r**
- radio frequency (RF) wave 300
- radio-signal phase analysis 68
- Raman–Nath diffraction 59–62
- reactive LiNbO_3 etching 301
- real-time holographic interferometry (RTHI) 445–447
- reflective polarizer 14
- refractive index 7, 33–35, 40, 50, 51, 59, 61, 63, 73, 75, 99, 124, 154–156, 176, 177, 179, 193, 196, 205, 207, 209, 218, 265, 270, 271, 273, 275, 276, 280, 283, 288, 294, 300, 312, 313, 328, 333, 335, 341, 343, 346–349, 351–353, 358, 359, 409, 411, 415, 418, 419, 421, 422, 424, 426, 435, 437, 441, 457, 459, 461, 462, 464–466, 468, 470
- refractive index control 358
- retardation 21, 24, 28, 36, 38–40, 146, 156, 201, 277–280, 300, 334, 335, 341, 342
- s**
- satellite and space-based AOTF applications 112–124
SPICAM-IR spectrometer 121–124
- scanning speed, of AOTF 88
- secondary effect 273
- second harmonic generation (SHG) 266, 268, 269, 288, 295–297, 338, 339
grating 295, 297
waveguides 269
- semiconductor optical isolators, ferromagnetic metals for 151, 152
- sensors, structure 314
- shunt resistance 119
- signal to noise ratio (SNR) 90, 226, 305, 335, 450
- silicates (hydr-) oxides 114
- silicon-based MO isolator and circulator 197–201
- silicon-ferrite photonic crystal, for THz circulator 190
- silicon waveguide-based modulators 364, 366
- single crystal LiTaO_3 photo-elastic modulator 51
- single crystal photoelastic modulator (SCPEM) 36–39
- sinusoidal filter 336, 337
- Smart-Spectra system 101, 102, 105, 106
- $\text{Sn}_2\text{P}_2\text{S}_6$ crystals, planar waveguide fabrication in 426
- sol-gel deposition 340
- solid immersion lens (SIL) 244, 245
- space-charge effect 349
- spatial light modulators (electrically addressed) 285
- spatial light modulators (optically addressed) 285–287
- spatial pattern of conductance 286, 287
- spectral resolution, of AOTF 88, 89
- SPICAM-IR spectrometer 121–124
- states of polarization (SoP) 10, 12, 212, 334, 335
- steady electric field 270, 277
- stress induced birefringence 28
- stress optical dispersion, of $\text{Li}_2\text{Ge}_7\text{O}_{15}$ crystals 53, 54
- strontium ruthenate (SrRuO_3) 292
- structural phase transitions 358, 359
- submicrometer lithium niobate slab waveguides 268
- superconducting magneto-optic modulator 168
- superconducting single-flux-quantum (SFQ) logic systems 166
- surface plasmon polarisation (SPP) 292

- surface plasmon polaritons (SPP) 269,
 355, 358, 364
 surface waveguide, in photopolymers
 457
 switching voltage 284, 292, 466
 symmetric Mach–Zehnder
 interferometer 317
- t**
- tapered antenna array 316, 318
 TE1000 electro-optic tunable etalon
 294
 tellurium dioxide (TeO₂) crystals 86,
 99, 116, 122, 125–131
 acousto-optical tunable filter
 126–128
 acousto-optic deflectors 128–131
 acousto-optic lens microscope 128
 Terfenol-D sensors 215–218
 tetrahertz magneto-optical circulator
 189–190
 tetrahertz magneto-optic modulator
 174–177
 Thales Alenia Space-Italy (TAS-I) 119
 thermal lens spectrometer, AOTF-based
 93–95
 thermoelectric cooler (TEC) 304
 thermomagnetic recording 220–222,
 224, 225, 229, 230, 233, 244
 thermo-optic or nonlinear polymer
 359
 thin film plate polarizer 20
 Thomas–Fermi screening theory 360,
 361, 363
 three-component photoelastic
 waveguide accelerometer 41,
 42
 three-dimensional waveguides
 (3D-WGs), in LiNbO₃ 428
 THz isolators 201–205
 based on metasurfaces 204–205
 based on plasmonics 201–204
 Ti-deep diffused SAWG 132
 time delay 334
 time reversed ultrasonically encoded
 (TRUE) optical focusing
 technique 454
 Ti-sapphire laser 68, 296
 Tl₃AsSe₃ crystals 87
 TM-mode waveguide isolators 194,
 195
 total internal reflection (TIR) 17, 211,
 340, 457, 458
 transimpedance amplifier 119
 transmission type VBG 469–471
 transmitted light intensity 285
 transparent conducting oxide (TCO)
 355–358, 360–371
 trapped charges 349, 411
 T-shaped magneto-optical circulators
 177–186
 tunable Fabry-perot filter (TFPF)
 329–331
 tunable Lyot filter (TLF) 329
 tuning coefficient 326, 327
 two-channel acousto-optic modulator
 68, 69
 two waves mixing 419, 420
- u**
- ultra-compact plasmonic modulators
 362–364, 366, 367
 ultrafast superconducting
 optoelectronics 166
 ultrahigh-density MO recording
 246
 ultrasound-modulated optical
 tomography 454–455
 unbalanced Mach–Zehnder electric
 field sensor 321
 uniaxial crystals 2–6
 indicatrix for 3
 ray surfaces of 4
 wave surface 4
 unwrapping phase techniques 447
- v**
- vanadium dioxide 359
 variable gain tilt filters (VGTF)
 335–338
 variable optical attenuators (VOA)
 269, 332–334, 337, 338
 Voigt effect 147, 149
 voltage-induced birefringence 329

volume Bragg gratings (VBG) based
 devices and subsystems
 473–475
 volume Bragg gratings (VBG) filters
 469–473
 advantages 472
 manufacturing 470
 operation principles 469
 recording 470
 spectral response 472
 in transmission/reflection mode
 469
 WDM combiners/splitters 473
 volume holograms 433, 445
 volume holographic data storage
 (VHDS) 423–425

W

waveguide electro-optic modulator
 289–292
 waveguide optical isolators 157, 191,
 193, 199, 200
 waveguide reflector 133–134
 wavelength dependent loss (WDL)
 333

wavelength division multiplexing
 (WDM) 83, 96, 154, 300, 329,
 335, 346, 423, 458, 468, 471, 473
 wavelength selectivity, of dynamic
 grating filter 437
 wave surface 4–6
 for biaxial crystals 5–6
 ordinary and extraordinary 4
 for uniaxial crystals 4–5
 whispering gallery mode (WGM) 325,
 326
 Wide-angle camera pair (WACs) 113,
 114

X

X-cut LiNbO₃ chip 303, 304

Y

yttrium iron garnet (YIG) 156, 158,
 167, 174, 191

Z

z-cut lithium niobate (LiNbO₃) 268
 0-gap directional coupler waveguide
 133

