

Index

- aberration correction, 160
- aberration sensing, 160
- absolute cell volume, 197, 208, 209, 210
- acoustic wave train, 269
- adaptive optics, 160
- angular dispersion, 101, 102, 104–7
- angular spectrum, 307
- angular spectrum method, 178
- aquaporins, 209
- artifact, 356
- automated 3D detection, 1, 35, 13, 61, 37, 138
- automated holographic analysis, 135

- back propagation, 56, 59

- carrier frequency, 154
- cell imaging, 197, 198, 206
- cell membrane fluctuations, 197, 208
- CGH *see* computer generated holograms
- chirp signal pattern, 271
- chromatic aberrations, 156
- classical reconstruction, 56, 60, 61
- coarse to fine processing, 66–8
- coherence parameter, 78, 79, 80, 82, 83, 90
- coherent anti-Stokes Raman scattering, 353
- color DHM, 132, 134
- complexity, 52, 65–9

- compressive sensing (CS, *also* compressed sensing or compressive sampling), 52, 75–6, 78–9, 81, 83, 85–6, 89, 91, 95, 371–9, 380–381, 385–6
- computational holography, 310, 313
- computer generated holograms (CGHs), 101, 102, 109, 115–22, 268, 271, 291, 293, 294–7, 299, 303, 310–313, 327–8
- Condon Shortley phase, 339
- contact-type, 268, 270, 271, 276, 281
- correlation (weighted and normalized), 60
- cotransporters, 212
- Cramér-Rao, 65, 68
- CS *see* compressive sensing
- cylindrical hologram, 332

- Dammann grating, 102
- dark field imaging, 164
- defocusing, 163
- 360 degree hologram, 327
- depth
 - estimation, 317
 - image-based rendering (DIBR), 317
 - information, 268
 - segmentation, 244, 258, 262
- dictionary of patterns, 59, 68–9
- differential interference contrast, 165

- digital holographic microscopy (DHM),
197, 200, 201, 202, 207
- digital holography, 4, 25, 30, 32, 75, 84, 85,
89, 226
- digital holography quantitative phase
microscopy (QP-QPM), 197, 200,
206, 211, 212, 213
- digital micromirror device (DMD), 267,
270, 272–3, 373, 377–9, 384, 388
- dispersion, 156
- dispersion compensation module (DCM),
107, 108
- display chips (*see also* spatial light
modulators), 269, 270, 272, 273,
297
DMD, 269, 270, 273, 297
- distortion correction, 316
- DMD *see* digital micromirror device
- dry mass, 197, 207, 208, 210
- elemental image, 276–8
- elementary hologram, 309
- epipolar plane image (EPI) analysis,
317
- estimation theory, 59–65
- fast Fourier transforms (FFT), 55
- fast off-axis DHM, 1, 30, 132
- field of view enlargement, 52, 59–64
- field-dependent aberrations, 162
- Fisher information matrix, 64
- fitting algorithm, 61, 62
- focussed light array (FLA), 269
- flat panel, 269, 270, 273, 276, 288, 291
- Fourier transform, 307, 310, 314
- free space propagation, 53, 107, 248
- free-viewpoint image, 321
- frequency bandwidth, 51
- Fresnel
approximation, 53
diffraction, 53, 311
number, 80, 81
transform, 53
- Fresnel-Kirchoff diffraction formula,
103
- full-parallax (FP), 304, 315
- full-parallax holographic stereogram
(FP-HS), 308
- global detection (exhaustive search), 59,
65–9
- glutamate, 210, 211, 212, 213
- gold nanoparticle, 186
- Green function, 329
- greedy algorithm, 59, 62
- group-velocity dispersion (GVD), 105, 106,
108
- Hankel function, 337
- Helmholtz equation, 329
- high speed imaging, 51
- high-speed parallel phase-shifting digital
holography system, 12
- hogel, 309
- hologram, 268, 269, 271, 272, 291, 292,
294, 295, 297–299
HPO, 295, 297
CCD, 291, 297
size, 269, 270
- hologram processing, 51–70
- holographic 3D printer, 308
- holographic classification, 1, 41, 142
- holographic imaging, 268–72, 291
acousto-optic modulator (AOM), 270,
271
Electro, 270, 271, 291
- holographic stereogram (HS), 308
- holography, 244
- horizontal parallax only (HPO), 304, 315
- ill conditioned problem, 57, 62
- image-based rendering (IBR), 308, 312, 321
- image
cell, 268, 276
resolution, 305
subtraction, 162
- imaging through turbid media, 26
- impulse response, 53, 55
- incoherent holography-multiple view
projection (MVP), 85, 86, 87, 93
- independent component analysis, 363
- infrared imaging, 33, 43, 45

- infrared radiation sensors, 33, 35, 36, 45
- in-line digital holographic microscope, 177
- in-line setup, 51–70
- integral imaging, 243, 243, 257, 261
- interference fringes, 268, 269, 291, 299
- inverse problems, 51–70
- integral photography (IP), 244–5, 249, 250, 255, 257–8, 260–262, 271, 272, 276–8
- isoplanatic, 160

- joint transform correlator, 235

- Koehler illumination, 157

- ℓ_1 -norm, 77, 372
- ℓ_p norm, 77
- least square solution, 59
- Lee Hologram, 269
- Legendre function, 337
- lensless imaging, 52
- lenticular plate, 279
 - slanted lenslets, 279
- life sciences applications, 129
- lightfield, 244, 246, 265, 303, 310, 315, 321
- limitation of back propagation, 57
- linear model, 54
- liquid crystal on silicon, 158
- liquid-crystal variable retarder, 374, 383–5
- local optimization, 59, 61, 68
- log-likelihood, 58, 60, 64
- Lohmann hologram, 268, 269, 297, 298
- low-coherence, 178, 189
- low-frequency attenuation filter (LFAF), 188

- maximum a posteriori (MAP) estimate, 62–4
- matching pursuit, 59
- matrix notation, 54
- metal nanoparticles, Surface Plamon Resonance, 227
- microgravity, 146
- microlens array, 244, 249
- micromachining, 119–21
- micro objects, 51

- micro-organisms, 139, 141
- Mueller matrix, 373–4, 386
- multiplexing schemes, 268–73, 290
 - image, 269–71, 290
 - spatial coherence, 268–71, 273–5
 - spatiotemporal, 268–70, 274, 275
 - time, 268–70, 272, 273, 275, 290
- multiscale algorithm (or multiresolution), 65–8
- multispectral imaging, 372, 377–85, 387–8
- multiview image, 268–74, 276–81, 283, 290, 297
- multiview imaging, 268, 270–272, 277, 290
 - aperture sharing, 273
 - diffraction grating, 281
 - horizontal parallax only (HPO), 273, 276, 278, 279
 - virtual voxel, 268, 272, 284, 285
- multi-wavelength sources, 1, 29, 133
- mutual occlusion, 314
- multiview (MV), 271, 272, 276–9, 281, 284

- nano objects, 51
- neuronal activity, 197, 200, 210, 211, 213
- neuronal swelling, 211, 212, 213
- noise model, 58
- nonlinear optical microscopy, 351

- occlusion culling, 313
- opacity distribution, 54, 62–4
- operating speed, 269, 273
- optical tweezers, 175, 177

- parallax, 244, 258, 261, 262
- parallel phase-shifting digital holography, 6
- parametric objects, 59
- pattern matching, 176
- phase added stereogram (PAS), 304
- phase contrast, 164
- phase information, 268, 291, 293, 294
- phase-shifting digital holography, 4
- phase stepper DHM, 130
- photoelasticity, 386
- photography, 243, 249, 251, 260, 261, 262, 263

- pixel cell, 268, 271, 272, 276, 277–9, 281–5, 285
 pixel integration, 56
 pixel-size, 269, 270, 294
 plenoptic, 243–58, 260–264
 point light source (PLS) array, 285
 point spread function, 333
 polarimetric imaging, 372–3
 polarization
 analyzer, 383–5
 distribution, 3, 77, 388
 object, 375
 state analyzer (PSA), 374
 state of, 373
 polystyrene nanoparticle, 184
 portable parallel phase-shifting digital holography system, 17
 programmable microscopy, 153
 projection type – high speed, 9–11, 270–272, 274, 275
 propagating matrices, 13, 61, 38, 140
 propagation of diffracted femtosecond pulses, 103
 propagation time difference, 101, 105, 117
 protein content, 197, 199, 206, 207

 quadrant photodiode (QPD), 175
 quantitative phase microscopy (QPM), 197, 198, 199, 200, 206, 208

 radiance map, 243, 244
 raman microscopy, 353
 ray transfer matrix, 103, 106, 107
 ray-based 3D display, 303
 rayleigh, 64
 length, 182
 scattering, 188
 ray-sampling plane (RS plane), 307, 311, 314, 318, 321
 ray-to-wavefront (R2W) transformation, 314
 red blood cells (RBC), 12, 91, 39, 14, 11, 45, 147, 208, 210
 refractive index (RI), 198, 206, 207, 208, 209, 210, 211, 213
 regularization, 57, 63

 resolution, 244, 258, 261, 262, 269, 270, 272, 277–80, 284, 288
 rigorous diffraction theory, 327
 rigorous point spread function, 336
 royer criterion, 52

 scanning vertical camera array, 315
 scattering, 44
 second harmonic signals, 115, 116
 second order analysis, 104, 105
 self occlusion, 314
 single-exposure on-line (SEOL) digital holography, 95, 96, 97
 shot noise, 353, 357
 single point resolution, 65
 single-pixel
 camera, 372–3, 375, 378, 381–2
 detector, 373–4, 377, 379, 383–4
 imaging, 372–3, 377, 382, 388
 single-shot femtosecond-pulsed parallel phase-shifting digital holography, 14
 singular value decomposition (SVD), 68–9
 SLM *see* spatial light modulator
 sparsity (signal), 62–4, 76–8
 spatial light modulator (SLM), 3, 73, 116, 117, 120, 158, 388
 spectral imaging, 358
 spectropolarimetric imaging, 382–3
 spherical harmonic transform, 339
 spherical hologram, 333
 STARFISH technique, 109, 111, 112
 stereo, 269, 272, 297–9
 matching, 317, 321
 microscopy, 169
 stereoscopic imaging, 270, 272, 273, 288
 eyeglasses type, 270, 272, 288, 289
 anaglyph, 272
 high speed shutter, 272, 273
 polarization, 272, 288, 289
 high speed LCD, 270, 273, 278, 288
 sharing pixel intensity, 288
 stereoscopy, 243, 244, 262
 stimulated Raman scattering, 352
 Stokes
 parameter, 373–7, 384, 386–8

- polarimeter, 374, 384–385–7
- vector, 374–6, 386
- Stokes-Mueller
 - calculus, 386
 - formalism, 374
- sub-pixel, 277, 279, 280
- sub-pixel estimation, 176, 181, 183
- sum of square difference (SSD), 180
- super resolution, 92, 229

- template matching, 180
- temporal coherence, 1, 29, 13, 21, 33, 134
- temporal stretching, 101, 102, 113, 120
- three-dimensional (3D), 243, 244, 245, 246, 249, 250, 251, 252, 254, 257, 261, 262
 - display, 243, 244, 245, 261
 - imaging, 51
 - reconstruction, 51
 - transmittance, 62
- tomography, 76, 85, 90, 93
- total variation (TV), 78, 87, 92
- tracking, 51
- trajectory reconstruction, 51
- transmembrane ionic currents, 211
- transmembrane water movements, 197, 208, 209, 210, 211, 213
- twilight field optical microscope, 188
- two-photon excited fluorescence, 351
- two-photon microscopy, 116–19

- viewing angle, 244, 262, 269, 294
- viewing zone, 268, 270, 272, 274–6, 279–81, 284
 - cross section, 271
 - forming geometry, 5
- virtual image (twin image), 56
- volumetric imaging, 268, 270, 271, 289, 290
 - contour image, 270, 271
 - different layer images, 270
 - rotating screen, 270
 - scanning laser beam, 270, 290
 - translating flat screen, 270
 - voxels, 269–71, 290
- voxel plane, 285
- viewing zone forming optics (VZFO), 276–9, 281, 288

- Walsh-Hadamard, 3, 73, 37, 63, 78, 386
- wavefront-based 3D display, 303
- wavefront-to-ray (W2R) transformation, 314
- weighted norm, 58
- weighted scalar product, 58

- zebra hologram, 269, 299
- Zernike phase contrast, 164