

Index

- 1D-II 70
- 2D morphing 165
- 2D-to-3D conversion 28
- 3D consortium 26
- 3DAV 26, 194, 204, 210, 211, 212, 214
- 3D display(s)
 - aerial image 252
 - aided viewing 237, 238
 - applications 235
 - autostereoscopic 28
 - barrier-grid design 255
 - colour multiplex 238
 - concave mirror technique 253
 - diffraction based 245
 - direction multiplex 244
 - electro holography 242
 - field-lens displays 250
 - free viewing 237, 242
 - head tracking 247
 - integral imaging 245
 - latent parallax barrier 255
 - lenticular imaging 247
 - location multiplex 240
 - moving-slit technique 256
 - multiview 28
 - multiview displays 248, 249, 252
 - occlusion based 254
 - parallax barriers 254
 - parallax combination technique 257
 - parallax illumination 256
 - polarization multiplex 239
 - prism mask 251
 - refraction based 245
 - retro-reflective technique 253
 - slanted raster 249
 - stereoscopic 28
 - taxonomy 237
 - time multiplex 239
 - virtual retinal display 241
 - volumetric 243
- 3D image warping 29–30
- 3D Measurements
 - accuracy 299, 301, 303, 306, 307, 308, 309, 310, 311, 312
 - ambiguity 305, 306, 307, 308
 - depth accuracy *see* 3D Measurements, accuracy
 - depth of field 306
 - divergence 303
 - measurement rate *see* 3D Measurements, speed
 - mixed point (problem) 303, 304, 307
 - spatial resolution 300, 303, 309, 310, 311
 - speed 301, 304, 308
- 3D Models
 - completeness 299, 300
 - interactivity 299, 300
 - time resolution 300
- 3D Room 65, 66
- 3D Sensors
 - active (sensors) 300, 308
 - continuous-wave 304
 - field of view 301, 305, 306, 307, 309, 310, 311
 - focal plane array 300, 308, 310, 311

- 3D Sensors (*continued*)
 footprint, laser 303, 304
 illumination 309, 310, 311
 phase-shift 304, 305, 306, 307, 308
 pulsed wave 303, 304, 305, 308
 scanner, laser 304, 305, 306, 307, 310, 311
 shutter, fast image 300, 309
 time of flight 303, 305, 307, 308, 311, 312
 triangulation 300, 301, 302, 310, 311, 312
 3D-TV 58, 59
 3D Video 55, 56, 66, 67
 3D video representation 82, 84, 85, 86
- AAC 207
 Accommodation 222–3, 236, 264
 Acoustic echo canceller (AEC) 178
 ActiveLENS 324
 Actor feedback 47
 Adaptive filter 177
 Adaptive echo canceller (AEC) 178
 Advanced Video Coding 26, 34–5
 Affine projection (AP) algorithm 179
 AFX 209
 Ambisonics 288
 Anaglyph 24
 Applications
 3D television 300, 311
 augmented reality *see* Applications, mixed reality
 city modelling 305, 310
 mixed reality 311
 urban modelling *see* Applications, city Modelling
 videoconferencing 300, 311
 virtual studios 310
 ARToolKit 321
 ARVIKA 331
 Aspen movie map 158
 Audience participation 12
 Audio coding 207
 Audiovisual position error 292f.
 Augmented reality 263
 Augmented virtuality 263
 Autocalibration 111
 AVC 203, 206
- Barker, Robert 10, 11
 Baseline 97, 102–3
 Bazin, André 7, 19
 Beamformer
 delay-and-sum (DSB) 186, 187
 minimum variance (MVB) 182
 superdirective 186, 187
 Bifocal tensor 110
 BIFS 205
 Billboards 171
 Binaural masking level difference (BMLD) 283f.
 Binaural reproduction 281, 287
 Binocular combination – asymmetrical 223–4
 Binocular lustre 223
 Binocular omni-oriented monitor (BOOM) 15
 Binocular rivalry 223
 Binocular stereo 115–25, 127
 Binocular summation 223
 Bird’s-Eye View System 60, 62
 Blue-C 87
 Body animation 209
 Body language 80
 Bundle adjustment 111
- Calibration 139
 Camera (projection) matrices 95, 97, 104
 Camera calibration matrix 95, 101
 Camera parameters 104
 Camera pose 103
 Camera projection centre 94–5
 Camera tracking 41, 48
 Canonical decomposition 112
 Cardboard effect 228
 CAVE Automatic Virtual Environment (CAVE) 15
 Central perspective panorama 159
 Central projection 94
 Cinema – widescreen 12, 13
 Cinema
 stereoscopic 24
 Cinerama 11–12
 Coarse-to-fine approach 119
 Cocktail-party effect 80
 Collineation 104
 Collision detection 52
 Communication 9
 Communication – mediated 18–19
 Communication – non-verbal 9, 18
 Computer graphics coding 208
 Content-based video coding 201
 Convergence 236, 264
 Correspondence 94, 97, 101, 105
 Correspondence search 115–30
 Corresponding points 97, 100, 106
 Cross product 99
 Cross-slit panorama 162
 Cross-talk 229
CyberSphere 15, 16
- DCT, discrete cosine transform 196
 Depth 96
 Depth-based extrapolation 167
 Depth compensated warping 167
 Depth cues 220–1
 Depth discrimination 222, 224
 Depth-image 27
 Depth-image-based-rendering 167
 Depth-keying 28
 Depth map (RGB + depth format) 226, 228
 Depth of field 236, 264

- Depth perception 220–4
Depth plane curvature 227
Depth-speed ambiguity 105
DIBR 167
Diplopia 222
Directional bands 283
Disparity 115–30, 154
Disparity – binocular 221
Disparity – crossed 221
Disparity – uncrossed 221
Disparity-based interpolation 165
Disparity constraints 116
Display
 Fresnel lenticular 78
 semitransparent 77, 78
Display – 3D 219–31
Display – autostereoscopic 229, 230
Display – head-mounted (HMD) 14–15
Display – predictive 17
DWT, discrete wavelet transform 197
- Echo return loss enhancement (ERLE) 178
Eight-point algorithm 101
EPI 159
Epipolar constraint 98, 104, 106
Epipolar geometry 96–100, 105
Epipolar image 143
Epipolar image analysis 143
Epipolar line 97–8, 100, 102, 104, 107–8, 143
Epipolar plane 97–8
Epipolar plane image 159
Epipole 97, 98, 101
Essential matrix 99–100, 105, 111
Euclidean stratum 111
Experience Theater 13
Extrinsic parameters 95, 99, 104
Eye contact 75, 78, 83, 85
Eye Vision 57, 58
- Face animation 209
Face-to-face 76, 77, 80
Face-to-face collaboration 329
Factorization method for reconstruction 106
Factorization of E 105
Factorization of F 106
Fine-to-fine approach 119
Focal plane 94
Free Viewpoint 55, 56, 57, 59, 60, 61, 70
Free-viewpoint video 212
Frobenius norm 101
FTV 59, 60, 61, 69, 70
Fundamental matrix 99–100, 105–6, 111
Fusion 222, 323
- Gaze direction 75, 79, 80
Generalized cross-correlation (GCC) 183
 phase transform (PHAT) 183
- Generalized sidelobe-canceller (GSC) 186
Gestures 76, 79
Ghosting *see* Cross-talk
- H.26x 203
Harmonic tunnelling 189
Head motion parallax 86
Head-related transfer function (HRTF) 282, 283, 287
Head tracking 47, 49
Head-up display 264
Heilig, Morton 13–14, 19
Hierarchical stereo analysis 119
High-resolution spectral estimation (HRSE) 182
Holographic optical element 78, 84
Homogeneous coordinates 95–6, 99–100
Horopter 221
Human factors 219–31
Huygens principle 288
Hybrid video coding 199
Hydra system 81
- IBR 151
ICT analysis 145
Im.point 85, 86
Image-based rendering 64, 66, 67, 151, 209
Image coding 194
Image cube 143
Image cube trajectory analysis 145
Image Domain 55, 56, 57, 59
Image flipping 230
Image plane 94
IMAX 12–13
Immersion – definition of 8
Immersive media 75
In-head localization 287
Individual differences 224
Integral photography 55, 56, 57, 68, 69, 164
Intelligent welding gun 330
Interactive rendering 210
Interaural level difference (ILD) 282
Interaural time difference (ITD) 282
Interface(s)
 collaborative 329
 multimodal 331
Intrinsic parameters 95, 99, 103–4, 111–12
IP 164
ITU 194
- JPEG 194, 202
JPEG 2000 202
- Keystone distortion 225, 227
- Laser scanner, use of 43
Lateralization 282

- Layered depth-images 37, 168
- LDI 168
- Left-right consistency check 123
- Light field 55, 56, 57, 62, 63, 64, 162
- Light Field Video Camera 62, 63
- Line-of-sight 77
- Loss control 177
- Low-frequency enhancement channel (LFE) 285
- Lumigraph 55, 163
 - unstructured 164
- MAJIC system 83
- Manifold mosaicing 159
- Marching cubes 136
- Marching-cubes algorithm 45
- Marching intersections 136
- Matching measures *see* Similarity metrics
- Matching, hybrid recursive 120–2
- MC/DCT 199
- MetaDESK 324
- Micro-facets 171
- Microphone array 175, 181
- Minor(s) 109–10
- Mismatches, detection of 124
- Mismatches, substitution of 124
- Mixed reality 237
 - applications 261
 - definition 261
- Mixed reality applications
 - collaborative 329
 - industrial 329
 - mobile 328
- Mixed reality display
 - articulated mobile system 276
 - desktop mixed reality system 273
 - FLOATS display 271
 - free-viewing displays 270
 - handheld mobile system 276
 - head-mounted display (HMD) 265
 - head-mounted projective display 269
 - mobile mixed reality system 275
 - occlusion handling HMD 268
 - optical, see-through display 266
 - super-multiview display 270
 - variable accommodation display 272
 - variable accommodation HMD 267
 - video, see-through display 269
 - virtual image overlay display 271
 - virtual retinal display 267
 - waveguide holographic HMD 266
- Model-based 55, 56, 57, 65, 67
- MONJUnoCHIE system 83
- Mosaic 159–61
 - concentric 161
 - manifold 159
 - see also* Panorama
- Motion compensation 199
- Motion estimation 199
- Move-matching 322
- Moving Pictures Expert Group 25
 - ad hoc* group on 3D audio/visual coding 26
 - video coding standards 25, 26
- MP3 207
- MPEG 194, 203, 204–14
- MPEG-2 26, 34–5
 - multiview profile 25
- MPEG-4 26, 34–5
- Multi-channel-audio reproduction 281, 284ff.
- Multi-hypothesis reconstruction 140
- Multi-linear constraints 109
- Multi-object audio reproduction 281, 287f.
- Multi-party communication 76, 79, 80
- Multi-texturing 67, 68
- Multi-view image 37
- Multimodal interaction 273
- Multiple-view constraints 109–10
- Musical noise 189
- Noise estimation 188
- Normalized coordinates 99–100
- Normalized least-mean-square (NLMS) algorithm 178
- NTII 84–6
- Null-steering 186
- Object-based video coding 201
- Occlusion handling 124, 129
- Occlusions 97
- Octree 137
- Omni-directional video 211
- Optical axis 94
- Optical centre 94
- Optical interactions 40
- Optical ray 95, 98
- Panorama 10–11, 159
 - see also* Mosaic
 - Panorama Mesdag* 10
 - Panorama of London* 10–11
- Panoramic video 211
- Panum's fusional area 222
- Parallax – screen 223, 226, 227, 229
- Parallax 154
- Perceptual audio coding 207
- Perceptual realism 19
- Personal interaction panel 324–5
- Perspective projection 94–5
- Phicon 324
- Photo-consistency 140, 141, 168
- Photo-hull 141
- Picket fence effect 230
- Pinhole camera 94–5

- Plane+Parallax 164
Plenoptic function 152
Plenoptic modeling 170
Plenoptic sample 152
Point at infinity 96, 98
Point rendering 210
Point transfer 107, 109
Point transfer problem 125
Pre-visualization 42, 44, 46
Prediction 194
Presence *see* Telepresence
Presence – co-presence 8–9
Presence – physical 8–9
Presence – social 8–9, 18–19
Principal axis 94
Principal plane 94
Projection equation 96, 110
Projective ambiguity 105–6
Projective depths 110–11
Psychoacoustics 282ff.
Puppet theatre effect 228
- Quadrifocal tensor 110
Quicktime VR 158
QVR 158
- Ray-Based Image Engineering 71
Rayspace 55, 56, 57, 59, 60, 61, 63, 64, 69, 70, 164
Real
 camera 154
 view 154
RealMeet 86
Reconstruction 94, 97, 104–6, 110–12
Rectification 99, 102
Rectifying transformation 103
Recursive least-square (RLS) algorithm 179
Registration 264
Reliability–accuracy problem 118
Rendering 56, 63, 64, 66, 67, 68
 depth-image-based 29
 image-based 23
Rigid displacement 105, 111–12
Round-table concept 80, 82, 83
- Sampling error 45
Self calibration *see* Autocalibration
Sensorama 13–14
Shape-from-contour 135
Shape-from-silhouette 135, 171
Shear distortion 229
Similarity metrics 117, 126, 128
Singular value decomposition (SVD) 110
Skew-symmetric matrix 99
SNHC 208
Space-carving 140
Spatial covariance matrix (SCM) 182
- Spatial perception 282ff.
 cocktail party effect 283f.
 direction 282
 distance 283
Spatial vision 236
Special effects 43
Spectral subtraction 189
Spherical projections 211
Standardization, data 101
Steered response power (SRP) 182
Stereo correspondences 102
Stereo parameter
 convergence distance 32
 focal length 32
 interaxial distance 32
Stereo system 99, 104
Stereoblindness 224
Stereoscope 24
Stereoscopic camera 225
Stereoscopic distance 265
Stereoscopic distortions 226–30
Stereoscopic geometry 225
Stereoscopic image production 225–6
Stereoscopic image quality 230–1
Stereoscopic television 219–31
Stratification 111
Super-sampling 46
Surface light field 56, 57, 64
Surface maps 165
Sutherland, Ivan 16
SVTE 76, 82, 84
- Tangible teleconferencing 325
Teleoperation 7, 16–18
TELEPORT 83, 84
Telepresence 76, 78, 79, 81
Telepresence – definition of 8–9
Telepresence – history of 7–20
Telepresence Wall 79
Teleprompter 77
Telerobotics 16–18
Teleteaching 78
Television
 three-dimensional 23–38
Texture slicing 168
Time-difference of arrival (TDOA) 181, 182, 183
Time-parallax format 25
Time-variant filtering 179
Tracker(s)
 AC 319
 acoustic 317
 DC 319
 hybrid 323
 inertial 318
 inside-looking-out tracker 320
 magnetic 318

- Tracker(s) (*continued*)
 marker-based tracker 320
 markerless 322
 mechanical 317
 model-based 322
 optical 320
 outside-looking-in 320
 video-based tracker 320
- Tracking 83, 85
 finger tracking 275
 gaze tracking 275
 head tracking 275
 Markerless object tracking 275
- Tracking, mixed reality 315
- Transfer function 177, 178, 179
- Transform coding 195
- Triangulation 104–6
- Trifocal geometry 106, 109, 112
- Trifocal plane 106
- Trifocal tensor 106–10
- Trifocal tensor warping 166
- Trinocular stereo 125–9
- Turntable 139
- Two-plane parameterization *see* Light field
- Two-view geometry 96
- Ultimate Display* 16
- Unstructured lumigraph 164
- User interface(s)
 gesture-based 325
 tangible 324
- VDTM 164, 169
- Video coding 194
- Video coding standards 203
- Video tunnel 77, 78
- Videoconferencing 9, 18, 75, 76
 commercial 80
 immersive 76, 85
 products 78
 seller 76
 semi-immersive 86
- Vieth–Müller circle 221
- View
 real 154
 virtual 154
- View-dependent geometry 169
- View-dependent multi-texturing 210
- View-dependent texture mapping 164, 169
- View maps 165
- View synthesis
 artifacts 32–4
 stereoscopic 30–2
- Virtual
 camera 154
 view 154
- Virtual environment (VE) 14–16
- Virtual reality (VR) *see* Virtual environment (VE)
- Virtual studio 41
- VIRTUE 85, 86
- Visual discomfort 223, 226–30
- Visual fatigue 265, 268
- Visual hull 135
- Visual hull computation 44–6
- Visualization 264
- Voice activity detection (VAD) 177, 188, 189
- Volumetric model 171
- Voxel 134, 171
- Voxel colouring 140
- VRML 205
- Waller Flexible Gunnery Trainer* 12
- Waller, Fred 11, 12
- Warping surface 169
- Wave field synthesis (WFS) 288ff.
- Weak calibration 102, 105–6, 111
- Wiener filter 189
- Windows, adaptive 118
- X-slits 162
- Zero-parallax setting 30







