Index

A

AAN (see aliasing as noise) aliasing, 7, 29, 51, 61, 87, 109, 149 aliasing as noise, 161, 177 analog filter, 58 angle space, 62 atmospheric transmission, 218 Auger recombination, 249 average display luminance, 142

B

background-limited *D**, 254 background photon flux, 256 bar targets, 130 bilinear interpolation, 90 blocked aperture MTF, 46 blur, 150 boost, 180

С

calibration constant, 152 camera, 5 cathode ray tube, 213 CCD (see charge-coupled device) chance, 47 charge-coupled device, 198-199 cold stop, 224 contrast enhancement, 180 contrast threshold function, 139, 277, 279 coordinate systems, 155 cortical filters, 139, 176, 197, 281 CRT (see cathode ray tube) CTF (see contrast threshold function) CTF_{sys} (see system contrast threshold function)

D

dark current, 247 depletion current, 250 detectivity, 252 detectivity model, 152, 172 detector bias point, 246 detector MTF, 40, 48, 226 detector noise, 223, 256 diamond-shaped detector, 41 diffraction MTF, 37, 46 diffusion current, 249 diffusion MTF, 226, 262 direct-injection circuit, 246 display format, 218 display glare (see glare) display luminance (see average display luminance and minimum display luminance) display MTF, 213 dither, 100 driving function, 10

E

effective blackbody temperature, 168 electron-hole pairs, 243 electronic stabilization, 55 enclosure flux, 224 equivalent bandwidth, 38 erf (see error function) error function, 145 exponential MTF, 48 eye model (see observer vision model) eye tracking, 51 eyeball MTF, 139, 280

F

field replication, 58, 111, 119 field test, 125 fill factor, 253 fixed pattern noise, 246, 257 flux model, 223 forcing function (see driving function) FPN (see fixed pattern noise) frame integration, 201, 282 frequency domain filters, 35

G

gain, 134, 198 Gaussian MTF, 48 glare, 142

H

HgCdTe, 259

I

identification task, 116, 118, 120, 123 image reconstruction (see reconstruction) imager gain (see gain) InSb, 259 interlace, 100, 200 interpolation, 15, 88, 90 interpolation MTF, 94 isoplanatic patch, 32

L

LCD (see liquid crystal display) level, 135, 198 linear shift invariant, 31 linearity, 9, 31 line-of-sight jitter, 49 liquid crystal display, 213 LOS jitter (see line-of-sight jitter) LSI (see linear shift invariant)

M

microscan, 99

minimum display luminance, 142 minimum resolvable temperature, 182, 187 mistake rate, 147 MODTRAN4, 221 modulation, 137 modulation transfer function, 33 motion blur, 57, 111 MRT (see minimum resolvable temperature) MTF (see modulation transfer function) multipixel interpolation, 90

N

natural illumination, 194 NEDT (see noise equivalent temperature difference) neural noise, 139 noise normalized, 151 spatial, 150 temporal, 152 noise current, 258 noise equivalent, 153 noise equivalent temperature difference, 255

0

observer training (see training) observer vision model, 139, 277 oculomotor system, 52 one-dimensional analysis, 43 optical transfer function, 33 optics MTF, 208 OTF (see optical transfer function)

P

Φ84, 145 photocurrent, 243, 256 photogenerated electrons, 243 photon model, 154 photovoltaic detector, 241 PID (see probability of identification) pixel replication, 90 Planck's equation, 171 point spread function, 31 postblur, 3, 7, 66 postsample (see postblur) preblur, 3, 7, 64 presample (see preblur) probability of identification, 124, 127, 144 proportionality constant (see calibration constant) psf (see point spread function) pyrometer temperature, 170

Q

quantal noise, 139
quantum efficiency η, 252
quantum well infrared photodetectors
 (QWIPs), 248

R

 R_0A , 243 radiative (band-to-band) recombination, 248 range performance, 144, 179, 202 readout integrated circuit (ROIC), 246 real MTF, 42 reconstruction, 5, 12 reflectivity model (see photon model) replication (see pixel replication) resolution, 131 response function, 10 responsivity, 252 ROIC (see readout integrated circuit) ROIC noise, 257

S

 S_{tmp} (see scene contrast temperature) sample imager, 3 sample imager response, 61, 68 sample phase, 66 sampling, 156 sampling process, 5, 7, 15 sampling theorem, 24 scene contrast temperature, 136, 176, 181 scene flux, 224 separability, 36, 144 shift invariance, 10, 31 Shockley-Read-Hall recombination, 249 signal, normalized, 151 signal reconstruction, 14 signal spectral density, 133 signature (see target signature) SIR function (see spurious imager response function) sky-to-ground ratio, 220 SMAG (see system magnification) snapshot, 201 spatial cues, 134 spatial domain filters, 35 spurious response (see also aliasing), 61 spurious imager response function, 67, 156 SRH recombination (see Shockley-Read-Hall recombination) symmetrical shape MTF, 42 system contrast threshold function, 140, 174, 196, 279 system magnification, 57–58

T

target contrast, 122, 133, 193 target identification (see identification task) target signature, 121 target test set (see test sets) targeting task performance metric, 133, 144 test sets, 123, 126, 128 thermal imager, 165 thermal signature, 167, 173 TOD (see triangle orientation discrimination) training, 122 transfer function, 33 triangle orientation discrimination, 184 TTP (see targeting task performance metric) turbulence, 223

V

visibility, 221 visual cortex filters (see cortical filters)

W

white frequency spectrum, 132



Richard H. Vollmerhausen currently consults in the areas of electro-optical systems analysis and modeling. He retired as head of the Model Development Branch at the U.S. Army's Night Vision Lab (NVL). During his tenure at NVL, the branch developed and validated a target acquisition metric to replace the traditional Johnson criteria. His experience includes project engineer and EO systems analyst for numerous Army weapon systems. His previous work include-

ed designing air-to-air missile seekers for the Navy and working as an instrumentation engineer for Douglas Aircraft on the Saturn/Apollo program. Mr. Vollmerhausen is the author of two books on electro-optical systems analysis and has published numerous journal and symposium papers.



Donald A. Reago, Jr. has 24 years experience in electrooptics gained through his work at the Army Night Vision Lab (now NVESD). His background includes development on infrared systems, component development technology, and signal processing/multisensor fusion for automatic target recognition. He currently serves as the Deputy Director for Technology and Countermine at NVESD.



Ronald G. Driggers received a doctorate in electrical engineering from the University of Memphis in 1990. Dr. Driggers has 23 years of electro-optics experience and has worked or consulted for Lockheed Martin (Orlando), SAIC, EOIR Measurements, Amtec Corporation, Joint Precision Strike Demonstration Project Office, Redstone Technical Test Center, and Army Research Laboratory. He was recently appointed to the Senior Executive Service as the Superintendent of the

Optical Sciences Division at the Naval Research Laboratory. Previously, he was the Director of the Modeling and Simulation Division at the U.S. Army's Night Vision and Electronic Sensors Directorate (NVESD). Dr. Driggers is the author of four books on infrared and electro-optics systems and has published over 100 research papers. He was Editor-in-Chief of the *Encyclopedia of Optical Engineering* (Taylor and Francis). He was selected as the 2002 Army Materiel Command's Engineer of the Year, the 2001 CERDEC Technical Employee of the Year, and the 2001 NVESD Technical Employee of the Year. He is a U.S. Naval Reserve Officer and was selected as the 2001 Naval Engineering Duty Officer of the Year (William Kastner Award). He is also a Fellow of SPIE, the Optical Society of America, and the Military Sensing Symposium. In January 2010, Dr. Driggers took over duties as Editor-in-Chief of SPIE's flagship journal, *Optical Engineering*.