

Acronyms and Abbreviations

ACA	Atacama Compact Array (Chile)
AEM	Alenia/Alcatel—EIE—MT Mechatronics consortium
ALMA	Atacama Large Millimeter Array (Chile)
APERTIF	Aperture Tile in Focus
ARGE	Arbeitsgemeinschaft (Consortium)
ASKAP	Australian SKA Precursor
ASTRON	Netherlands Institute for Radio Astronomy
ATA	Allen Telescope Array (USA)
AUI	Associated Universities Incorporated (USA)
Az	Azimuth
BDF	Beam Deviation Factor
BIMA	Berkeley Illinois Maryland Array (USA)
BUS	Backup structure
CAD	Computer-Aided Design
CAMRAS	C. A. Muller Radio Astronomy Station (Netherlands)
CARMA	California Array for Millimeter Astronomy
CCD	Charge-Coupled Device
CD	Cradle
CFRP	Carbon fibre reinforced plastic
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Aus.)
CSO	Caltech Submillimeter Telescope Observatory (Hawaii)
E-ELT	European Extremely Large Telescope (ESO, Chile)
EIE	European Industrial Engineering (Italy)
EI	Elevation
EI-Az	Elevation over azimuth mount
ELC	Elevation cradle
ELT	Extremely Large Telescope
EM	Electromagnetic
ERS	Elevation rotating structure

ESA	European Space Agency
ESO	European Southern Observatory
ESSCO	Electronic Space Systems Corporation (USA)
FAST	Five-hundred-meter Aperture Spherical Telescope (China)
FBC	Flexible Body Compensation/Control
FDR	Final Design Review
FEA	Finite Element Analysis
FRAN	Framed Structures Analysis Program
FOV	Field of View
GBT	Green Bank Telescope (USA)
GMRT	Giant Metrewave Radio Telescope (India)
GMT	Giant Magellan Telescope (Chile)
GTM	Gran Telescopio Millimétrico (LMT) (Mexico)
HHT	Heinrich Hertz Telescope (USA)
HPBW	Half-power beamwidth
IGN	Instituto Geográfico Nacional (Spain)
INAOE	Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico)
INVAR	Very low expansion steel
IRAM	Institute for Radio Astronomy in the Millimeter Range (France)
JCMT	James Clerk Maxwell Telescope (Hawaii)
JPL	Jet Propulsion Laboratory (USA)
LBT	Large Binocular Telescope (USA)
LES	Lincoln Laboratory Experimental Satellite
LFST	Largest Feasible Steerable Telescope
LMT	Large Millimeter Telescope (GTM) (Mexico)
MAN	Maschinenfabrik Augsburg Nürnberg (Germany)
MERLIN	Multi-Element Radio Linked Interferometer Network (UK)
MIT	Massachusetts Institute of Technology (USA)
MPG	Max-Planck-Gesellschaft (Germany)
MPIfR	Max-Planck-Institut für Radioastronomie (Germany)
MRT	Millimeter Radio Telescope
NAOC	National Astronomical Observatory of China
NAOJ	National Astronomy Observatory of Japan
NASA	National Aeronautics and Space Administration
NOEMA	Northern Extended Millimeter Array (IRAM, France)
NRAO	National Radio Astronomy Observatory (USA)
NRL	Naval Research Laboratory (USA)
NSF	National Science Foundation (USA)
OVRO	Owens Valley Radio Observatory (USA)
PAF	Primary Focus Array
PDR	Preliminary Design Review
RC	Ritchey–Chrétien
RS	Reflector surface
SETI	Search for Extra-Terrestrial Intelligence

SKA	Square Kilometre Array
SMA	Submillimeter Array (Hawaii)
SMT	Submillimeter Telescope (USA)
SOW	Statement of Work
SRT	Sardinia Radio Telescope (Italy)
STAIR	Structural Analysis Interpretive Routine
TIW	Toronto Iron Works (USA)
TMT	Thirty Meter Telescope (optical)
UMass	University of Massachusetts at Amherst (USA)
VLA	Very Large Array (USA)
VLBI	Very Long Baseline Interferometry
VLT	Very Large Telescope (ESO)
VWF	Volkswagen Foundation (Germany)
WSRT	Westerbork Synthesis Radio Telescope (Netherlands)

Glossary

- Antenna** Device to receive or transmit electromagnetic radiation. Here used as an alternative for reflector or radio telescope.
- Aberration** Deviation of perfect behaviour by the telescope caused by shifts or deformations of the optical system.
- Alidade** Section of the telescope that provides azimuth movement and carries the elevation structure and reflector
- Angular resolution** Measure for the “sharpness” of view of the telescope; the angle on the sky where two stars can just be seen separately (see beamwidth).
- Aperture** Area over which a telescope captures radiation.
- Aperture efficiency** Percentage of power entering the aperture that actually reaches the focus.
- Astigmatism** Saddle-like deviation of reflector leading to a distortion of the beam with different foci in perpendicular planes
- Astrodome** Protective enclosure for the telescope that opens over the width of the telescope during observation. It co-rotates with the telescope.
- Azimuth** Angle along the horizontal plane. Normally, starting with zero in the North and advancing through East from 0 to 360 degrees
- Backup structure (BUS)** Support structure between reflector and elevation structure.
- Beam** The representation of the relative sensitivity of the antenna over all directions.
- Beamwidth** Angular width of the “main beam” over which the antenna collects most radiation. The half-power beamwidth (HPBW) is the angle where the sensitivity has decreased to half w.r.t. the peak value. It is used as a basic parameter characterising the angular resolution of the antenna.
- Blocking** Area of the aperture that radiation cannot reach by structural obstruction, such as a quadripod support of a secondary reflector.
- Carbon fibre reinforced plastic (CFRP)** Composite material of carbon fibres embedded in an epoxy matrix. Advantages are a large strength-to-weight ratio and a very small coefficient of thermal expansion.

- Cassegrain optics** Telescope with two mirrors. A hyperbolic secondary mirror reflects the radiation from the primary paraboloid back to a secondary focus, often behind the primary, reached through a central hole in the primary reflector. Named after its proposer Cassegrain.
- Cladding** Cover on the outside of the telescope structure providing protection from weather. Often includes thermal insulation.
- Coma** Up-down (or left-right) large-scale deviation of reflector leading to a shift in the beam direction and a strong asymmetric sidelobe.
- Commissioning** Process of testing to determine the specified performance of a telescope
- Direct drive** An electric motor directly drives the telescope axis without any intermediate gears.
- Elevation** Angle in the vertical plane from 0 degree at horizon to 90° in the zenith (overhead).
- El-Az** Shorthand for Elevation—Azimuth, indicating the two axes about which the telescope is rotated to reach a chosen direction on the sky.
- El-Az-mount** Telescope with movement in azimuth (around the vertical azimuth axis) and elevation (around the horizontal elevation axis).
- Elevation structure** Connection from BUS to the elevation bearings.
- Feed** Element in the focus, often a horn, that captures the radiation and transfers it to the receiver.
- Field of view** Angular area of sky available to the telescope beam.
- Finite element Analysis** Method to mathematically analyse the behaviour of a large physical system by dividing it into small, more easily analysed elements.
- Flexible Body Control** Method to counteract deformation of a flexible body through the use of data collected by sensors located on or near the body.
- Focus** The location where the radiation received by the telescope is concentrated.
- Gain** A measure for the sensitivity of the antenna or telescope, proportional to the effective aperture area.
- Gregorian optics** Telescope with two mirrors (see Cassegrain). In this case, the secondary mirror is an ellipsoid. Named after its proposer Gregory.
- Homology** Design method to control structural deformations so as to preserve the paraboloidal shape as function of orientation allowing a change in focal length and axis direction.
- Horn** Element to radiate or receive electromagnetic radiation, widely used as feed (see there) in the focus of the telescope. Parameters of a horn can be accurately calculated; hence, the horn is used for absolute calibrations of antenna sensitivity (gain).
- Interferometer** The signals of two or more separated antennas are combined to form an interference pattern that provides angular resolution proportional to the largest distance between the antennas.
- Load/loading** Force exerted on the structure from gravity, wind and thermal expansion.

- Master equatorial** Mechanical/optical device to transform celestial coordinates to instrument (azimuth–elevation) coordinates.
- Mount/mounting** Telescope structure that carries the reflector and enables the movement in azimuth and elevation.
- Offset optics** The primary reflector is a section of a larger paraboloid outside the symmetry axis of this paraboloid. Thus, the focus lies outside the aperture and blocking of the aperture is avoided. Example is the small dish for home reception of TV satellites.
- Pintle bearing** Central bearing on the telescope's azimuth axis.
- Pointing** The direction of viewing represented by the readings of the axis angular encoders (elevation and azimuth angle).
- Pointing model** Set of parameters representing inaccuracies in the telescope's geometry to adjust the commanded pointing direction to coincide with the true pointing direction.
- Polar/equatorial mount** Telescope with one axis parallel to the earth axis, allowing tracking a star by rotation about this axis only. The second axis sets declination.
- Prime-Focus Array (PAF)** Multi-element feed in the focal plane to increase the field of view and project a number of beams on the sky.
- Quadripod** Four-legged support of the secondary reflector or the primary focus equipment in the focus of the primary reflector (sometimes a tripod).
- Radio holography** Method to measure the geometrical shape of the reflector with the aid of a radio signal. The measured deviations from the theoretical shape are used to adjust the reflector to the correct curve.
- Radome** Fully closed protective structure for the telescope: a space-frame truss covered with a fabric that is transparent to the radio radiation.
- Receiver** Electronics that amplify and process the received radiation.
- Reflector** Essential part of the telescope that reflects the incoming radiation to the focal point.
- Ritchey–Chrétien optics** Telescope with two hyperbolic reflectors without coma aberration, thereby providing a large field of view.
- Scattering efficiency** Percentage of power that is scattered away from the main beam by imperfections in the geometrical shape of the reflector.
- Sidelobe** Secondary, normally weak, feature around the central beam.
- System Engineer** Person responsible for a complete and technically adequate realisation of a project
- Zenith** Point on the sky directly overhead from the viewer's position.

Name Index

A

Aerospace Corporation, 108
Alcatel, 165
Alcatel-EIE-MAN (AEM), 165, 166, 168,
170–181, 223
Alenia-EIE-MT Mechatronics (AEM), 182
Alenia Space, 165
Algonquin Park, 49, 50
Allen Telescope Array (ATA), 194–196
Allen, R.J., 192
ALMA, 6, 140, 145, 154, 155, 162–182, 223,
230, 233, 244, 246, 250, 251
Altmann, H., 76, 82, 83, 88
APEX, 137, 167, 236
Apollonius, 10
Archimedes, 1, 2, 10
Arecibo, 67, 186, 187, 189, 245
Ashton, E.L., 53
ASKAP, 237
ASTRON, 237, 245
Atacama Compact Array (ACA), 165, 181

B

Baars, J.W.M. (JB), 26, 96, 127, 132, 134, 137,
140, 162, 167, 191, 210, 211, 213, 223,
227–229, 231, 233
Becker, F., 73
Bell Laboratories, 33, 109, 194, 195
Bennett, J.C., 232
Berkeley-Illinois-Maryland-Array (BIMA),
156
Bliss Company, 55
Bolton, J.G., 49
Bowen, E.G., 47

Brandt, P., 82, 118
Bregman, J.D., 155
Bremer, M., 130
Bristol Steel and Iron, 56
Brotten, N.W., 192
Caltech Submillimeter Observatory (CSO),
154–157, 159, 246
CAMRAS, 31, 38
Cassegrain, L., 12, 17, 19–21, 26–28, 42
Chajnantor, 6, 163, 164, 181, 246
Chu, T.S., 193
California Array for Millimeter Astronomy
(CARMA), 156
Cook, J.S., 193
Crawford, A.B., 192
CSIRO, 47–49, 51, 52, 245

C

DeBoer, D.R., 237
Dornier, 116, 159
Dragone, C., 194
Dwingeloo, 3, 23, 31, 36–41, 44, 45, 50, 81,
204, 244, 245, 247

E

Effelsberg, 4, 21, 41, 54, 64, 65, 71–95, 101,
106, 112–116, 118–122, 124, 133, 137,
139, 168, 169, 174, 199, 201–204, 245,
248, 249, 251, 252
Erickson, N.R., 235
ESA, 18, 139, 253
Eschenauer, H., 82, 117, 125
ESO, 163–165, 233, 253

ESSCO, 57, 132, 134, 249
 European Industrial Engineering (EIE), 165,
 170–181

F

Faraday, M., 13
 Findlay, J.W., 55, 56, 69, 70, 72, 186, 191, 231
 Five-hundred-meter Aperture Spherical
 Telescope (FAST), 67, 189, 246, 251
 Freeman Fox, 47, 81

G

Galilei, G., 11
 Galindo, V., 234
 Giant Metre wave Radio Telescope (GMRT),
 190–192, 248
 Ginat, M., 187
 Gordon, M.A., 109
 Gordon, W.E., 186
 Gran Telescopio Millimétrico (GTM), 132,
 136–138, 143, 244
 Green Bank, 21, 33, 34, 47, 50, 52, 54, 57, 64,
 69, 109, 191, 193, 198–206, 231
 Green Bank Telescope (GBT), 57, 198–206
 Gregory, J., 11, 19–21, 26, 28, 42, 186, 210
 Greve, A., 130, 131, 168, 220
 Guilloteau, S., 158

H

Hachenberg, O., 73–75, 77–79, 112, 252
 Hall, P.J., 195, 235
 Hall, B., 56
 Haystack antenna, 67, 248
 Heinrich Hertz Telescope (HHT), 154, 155,
 157–164, 168, 181, 250
 Heaviside, O., 209
 Herschel, W., 12, 43
 Hertz, H., 2, 6, 14, 17, 32, 73, 159–162, 168
 Ho, P.T.P., 154
 Höfling, E., 146
 Hooghoudt, B.G., 37, 95, 96
 Hülsmeier, C., 32
 Husband, H.C., 42, 43, 47, 53, 81

I

Iguchi, S., 181
 Imbriale, W.A., 234
 Ingalls, R.P., 60

Institute for Radio Astronomy in the Millimeter
 range (IRAM), 112–132, 155, 157–162,
 168, 218, 219, 249
 Instituto Geográfico Nacional (IGN), 76,
 103–105, 135
 Instituto Nacional de Astrofísica, Óptica y
 Electrónica (INAOE), 132, 133, 136
 Ivashina, M., 237

J

James Clerk Maxwell Telescope (JCMT), 134,
 154, 155
 Jansky, K.G., 17, 32, 33, 41, 51, 244
 Jeffs, B.D., 237
 Jennison, R.C., 232
 Jet Propulsion Laboratory (JPL), 19, 204, 234
 Jodrell Bank, 3, 23, 38, 42–47, 50, 53, 64, 67,
 73, 81, 96, 99, 186, 203, 233, 244
 Jonas, J.L., 196

K

Kärcher, H.J. (HK), 25, 137, 140, 143
 Kiepenheuer, K.O., 34
 Kildal, P.S., 186
 Korolkov, D.V., 187
 Kramer, C., 218
 Kraus, J.D., 186–189
 Krupp, 73, 74, 76–78, 87, 88, 90, 96, 117, 159,
 252
 Kuz'min, A.D., 231

L

Laing, R., 181
 Large Binocular Telescope (LBT), 13
 Large Millimeter Telescope (LMT), 76,
 132–141, 143, 147
 Largest Feasible Steerable Telescope (LFST),
 65, 76
 Leighton, R.B., 155, 156
 Levy, R., 234
 Lincoln laboratory Experimental Satellite
 (LES)
 Lipperhey, H., 11
 Lockman, F.J., 52
 Lovell, B., 42–47, 49, 73, 74, 80, 99, 201, 202
 Low, F., 109

M

Mäder, H.F., 159

Mangum, J.G., 168, 175, 181
 Marconi, G., 32
 Maschinenfabrik Augsburg Nürnberg (MAN),
 49, 73–79, 87, 99, 113–115, 134–137,
 158, 161, 252, 257
 Massachusetts Institute of Technology (MIT),
 55, 57–60, 210, 237
 Mausekopf, P., 133
 Max-Planck-Institut für Radioastronomie
 (MPIfR), 73, 113, 117, 118, 159, 250,
 252
 Max-Planck-Society (MPG), 73
 Maxwell, J.C., 13, 14, 17, 55, 155, 210
 Menaechmus, 10
 Mersenne, M., 2, 11
 Mezger, P.G., 75, 109, 112, 252
 Millimeter Radio Telescope (MRT), 76, 91, 94,
 96, 101, 112–132, 135, 137–140, 143,
 147, 149, 151, 157, 168, 169, 250
 Minh, Y.C., 235
 Mitsubishi, 144, 165, 166, 181, 182
 Mizuguchi, Y., 194
 Moran, J.M., 154
 MT Mechatronics, 165, 182, 197, 204, 257
 Muller, C.A., 35
 Multi-Element Radio Linked Interferometer
 Network (MERLIN), 96, 98–105, 135,
 137, 138

N

Nan, R., 189
 Nasmyth, J., 19, 29, 95, 113, 116, 118, 135,
 145, 161
 National Aeronautics and Space
 Administration (NASA), 133, 234
 National Astronomical Observatory of China
 (NAOC), 67
 National Astronomical Observatory of Japan
 (NAOJ), 144
 National Radio Astronomy Observatory
 (NRAO), 19, 33, 34, 50–58, 64, 65, 69,
 72, 75, 109–113, 133, 164, 191, 193,
 198, 199, 201, 234, 235, 247, 248, 251
 National Science Foundation (NSF), 33, 54, 56,
 58, 109, 110, 112, 164
 Naval Research Laboratory (NRL), 36
 Newton, I., 12
 Northern Extended Millimeter Array
 (NOEMA), 158
 Nusselt, W., 147

O

Olmi, L., 133
 Oort, J.H., 35, 37
 Owens Valley Radio Observatory (OVRO),
 156

P

Palomar, 13, 25, 53, 54, 155
 Pappus, 10
 Parsons, W., 12, 13, 42
 Peng, B., 189
 Penzias, A.A., 192, 194
 Perley, R., 228
 Prestage, R.M., 199
 Priester, W., 73

R

Ramsay, J.F., 233
 Reber, G., 32–34
 Reynolds, O., 147
 Ritchey-Chrétien (RC), 17, 28, 236
 Robinson, P., 49
 Rusch, W.V.T., 238
 Ruze, J., 24, 108, 213, 215, 217, 218, 220, 222,
 225, 237

S

Sardinia Radio Telescope (SRT), 204–206
 Schönbach, W., 75
 Scott, P.F., 233
 Search for Extra-Terrestrial Intelligence
 (SETI), 194
 Seidel, L., 220, 221, 240
 Serabyn, E., 156
 Shklovski, I.S., 34
 Silver, S., 210, 211, 234
 Siringo, G., 235
 Small, M.M., 55
 Snel, R.C., 167
 Square Kilometre Array (SKA), 6, 195–198,
 235, 250
 Stenvers, K.-H., 159
 Stockert, 36–41, 47, 53, 73, 244, 247
 Stone & Webster, 55
 Stumpff, P., 229
 Sub-Millimeter Array (SMA), 154
 Sub-Millimeter Telescope (SMT), 154
 Swarup, G., 191
 Swenson, G.W., 186

T

Thirty Meter Telescope (TMT), 34
 Toronto Iron Works (TIW), 132, 133, 135, 140

U

Univ. Massachusetts, 132, 235, 249
 Univ. Texas, 108

V

van Ardenne, A., 237
 van Cappellen, W.A., 237
 van de Hulst, H.C., 34, 37
 Vertex, 134, 135, 165, 166, 168–182, 223
 Very Large Array (VLA), 165, 166, 235, 248, 250, 251
 Very Large Telescope (VLT), 13
 Very Long Baseline Interferometry (VLBI), 103, 143, 235, 248, 251
 Vinci, L da., 9, 10

Volkswagen Foundation (VWF), 73, 74
 von Hoerner, S., 4, 55, 64–68, 70–76, 81, 88, 90, 94, 106, 237, 248

W

Wallis, B., 47–49
 Weiss, H.G., 60
 Westerbork Synthesis Radio Telescope (WSRT), 95–97, 99, 100, 237, 248
 Welch, W.J., 194
 Wilson, R.W., 18, 28, 109, 192, 194
 Wong, W.Y., 55, 69, 94
 Woody, D.P., 156
 Wootten, A., 163
 Würzburg Riese, 34, 35, 244

Z

Zernike, F., 220, 221, 238–240

Subject Index

A

- Aberration, 12, 17, 121, 125, 133, 134, 146, 151, 154, 163, 190, 215, 220–222, 224, 236, 238, 240
- Absorption area, 214
- Accelerometer, 167
- Adjuster, 117, 133, 135, 136, 155, 173, 200, 231, 232, 249
- Air mass, 127
- Alidade, 74, 80, 114, 116, 118, 119, 133, 137, 142, 144, 145, 169, 200–204
- Antenna
 - Cassegrain, 26
 - communication, 115
 - deep-space, 133
 - measurement, 231
 - offset, 21, 193–196, 198
 - reflector, 2, 6, 26–28, 108, 147, 192–203, 210, 211, 213–218, 220, 221, 223, 225, 227–229, 231, 233–240, 247, 248
 - solid angle, 213, 214
 - temperature, 42, 111, 156, 168, 174–177, 182, 195
- Aperture
 - blocking, 42, 196, 200, 215, 222
 - illumination, 211, 231
 - integration, 239
- Array, 17, 28, 60, 96–98, 100, 113, 154, 158, 162–182, 190, 192, 194–197, 228, 233, 235–237, 245–248, 250
- Astigmatism, 45, 55, 99, 101, 121, 130, 131, 169, 175–178, 220–222, 236, 240
- Astrodome, 133, 135, 155, 156
- Atmosphere, 5, 15, 16, 18, 127, 134, 158, 159, 164, 182, 229, 249

Atmospheric fluctuation, 117, 231

Axis

- azimuth, 5, 18, 19, 32–35, 37–41, 43, 45, 46, 49–53, 57, 59, 78–80, 111, 113, 115, 118, 133, 135, 145, 167, 170, 173, 175, 177–180, 187, 197, 200, 203, 204, 225, 230, 247
- elevation, 18, 19, 195, 197
- encoder, 168
- polar, 18, 53–55, 96, 97, 99

B

- Back focal distance, 26, 29
- Backlash, 179
- Backscattering, 186
- Backup structure (BUS), 23, 29, 37, 39, 41, 43, 46, 49, 50, 53–55, 59, 74, 76, 78, 80–95, 100–102, 104, 111, 116, 119, 136, 138, 139, 144, 147, 149, 155, 171, 173, 175, 177, 181, 191, 196, 200, 217, 218, 231, 249
- Baseline, 98, 158, 162–164, 182, 196, 248
- Beacon, 232
- Beam
 - efficiency, 210, 213, 214, 222
 - pattern, 211, 213, 214, 218–220, 223–225, 228, 231
 - shift, 46
 - solid angle, 213, 214
- Beam-deviation-factor (BDF), 227
- Beamwidth, 52, 65, 142, 145, 154, 164, 187, 210, 212–214, 230, 247, 250
- Bearing
 - hydrostatic, 53, 54, 133, 247

- Bearing (*cont.*)
 pintle, 135, 137, 200
 roller, 39
- Bessel functions, 211
- Best-fit, 67, 74, 76, 88, 229
- Blocking, 42, 119, 133, 134, 171, 193, 213, 215, 222–224, 228
- Box structure, 159
- Brightness
 distribution, 60, 248
- C**
- Calibration, 164, 165, 191, 210, 228, 230
- Calibration source, 164
- Carbon-fibre reinforced plastic (CFRP), 2, 6, 117, 118, 139, 140, 145, 155, 157–162, 168, 173, 177, 181, 197, 238, 250
- Carbon-monoxide (CO), 4, 60
- Cassegrain optics, 19, 26, 124, 210, 226, 250, 264
- Cassiopeia A, 191, 193
- Caustic, 186
- Coma, 28, 49, 50, 77, 101, 104, 105, 122–125, 169, 174, 175, 186, 213, 220–222, 225, 226, 235, 236, 240
- Communication, 2, 13, 19, 21, 32, 76, 99, 157, 192, 194, 212, 214, 216, 231–235, 251
- Conduction, 145
- Conic sections, 10, 12
- Contour plot, 87, 88, 90, 92, 93, 123, 125, 126, 221, 222
- Convection, 145, 147
- Coordinates
 Cartesian, 28
- Correlation length, 217–219
- Cosmic Microwave Background, 192, 194
- Cosmic source, 165, 191, 228–231
- Cradle (CD), 34, 49, 65, 71, 75, 77, 81, 82, 95–97, 100, 101, 104, 114, 118, 119, 127, 132–134, 191, 200
- D**
- Declination, 18, 37, 50, 54, 56, 96, 97, 186, 187, 190
- Defocus
 axial, 215, 224–226
 lateral, 225, 226
- Delay error, 143
- Deviation, 24, 37, 74–78, 88–90, 92, 94, 102, 108, 111, 114, 125, 164, 191, 205, 210, 215–217, 220, 227, 229, 232, 234, 238, 239
- Diffraction, 210, 218, 236
- Direct drive, 111
- Directivity, 210
- Distortion, 122, 217, 220–222, 224, 225, 240
- Dome, 23, 66, 110–112, 164
- E**
- Eccentricity, 10, 27, 28, 89, 236
- Effelsberg telescope, 4, 41, 54, 65, 71, 72, 79, 81, 92, 94, 95, 112, 116, 133, 252
- Efficiency
 aperture, 108, 154, 159, 213–217, 225
 beam, 210, 213, 214, 222
 blocking, 213, 215, 222–224
 illumination, 215, 216, 234
 polarisation, 194, 215, 216
 radiation, 215, 217
 scatter, 213
 spillover, 215, 216
- Electroform, 171
- Elevation, xvi–xxi, xxiii–xxv, 3, 5, 18, 20, 34, 40, 44, 49, 50, 59, 67, 70, 73, 76, 78, 80, 81, 84, 86, 87, 95, 99, 103, 116, 118, 121, 124, 125, 129, 131, 132, 138, 143, 145, 160, 167, 169–171, 173, 175–177, 180, 183, 188–190, 193, 196, 197, 200, 225, 228, 244, 247–249
- Elliptical, 11, 12, 20
- Epoxy resin, 97
- Equatorial mount, 19, 35, 52, 96
- Equivalent paraboloid, 27, 28, 226
- Error beam, 218, 219
- Error patches, 218
- F**
- Far-field, 232
- Feed, 17, 21, 29, 38, 40, 42, 45, 56, 57, 110, 111, 168, 186, 187, 190, 193–195, 211, 213, 215–217, 220, 222, 224–227, 235, 236, 238
- Feed pattern, 234
- Field curvature, 220, 240
- Field distribution, 232
- Field electromagnetic, 13, 194
- Finite element analysis (FEA), 2, 57, 64, 68, 114, 116, 130, 141, 160, 220, 238, 239, 248
- Flexible body compensation (FBC), 136
- Flux calibration, 191

- Flux density, 191, 193, 228
 Focal plane, 15, 17, 19, 25, 26, 28, 137, 235–237
 Focus
 Cassegrain, 17, 27, 118, 235
 error, 215
 Gregorian, 26, 145, 199, 264
 Nasmyth, 29
 primary, 21, 26, 29, 38, 41, 42, 113, 124, 200, 210, 222, 223, 226, 235, 236
 secondary, 12, 21, 26, 29, 124, 197, 199, 226, 235
 Fourier transformation (FT), 231, 232
 Four-point support, 5, 59, 64, 95–104
- G**
 Gain function, 211, 214
 Gaussian distribution, 211
 Gear, 54, 56, 179, 180
 Geometric optics, 10, 210, 235
 Gravity, 2, 59, 65–67, 81, 83, 84, 86–89, 92–94, 98, 102, 103, 121–125, 138, 139, 141, 142, 167, 169, 174, 175, 200, 215, 217, 220, 221, 239, 240
- H**
 Half-power beamwidth (HPBW), 24, 25, 108, 213, 214, 232
 Heat
 convection, 146
 radiation, 126, 146, 147
 Holography
 radio, 132, 167, 231, 232
 Homologous deformation, 64, 65, 68, 106, 118, 237, 248
 Homology, 2, 4, 5, 47, 118, 121, 140, 162, 169, 194, 200, 229, 248, 249
 Honeycomb, 79, 116–118, 140, 145, 155–158, 171, 173
 Horn, 17, 21, 29, 186, 190–192, 194, 235, 238
 Hour-angle, 18, 19, 37, 50, 53, 54
 Hydrogen, 3, 17, 34, 35, 43, 109, 244, 247
 Hyperbola, 10, 26, 28
- I**
 Illumination function, 211–216, 223, 225–227, 231, 235
 Insulation, 5, 54, 55, 117, 118, 127–130, 144, 145, 147–151, 160, 168, 173
 Interference, 32, 42, 44, 73
 interferometer, 35, 36, 98, 108, 113, 145, 156, 161, 168, 237, 247, 248, 250
 Invar, 159, 160, 168, 171–173, 177, 181
 Isostatic, 67, 100, 136
- J**
 Jansky (Jy), 17, 32, 33, 41, 51
- K**
 Kirchhoff's law, 146
- L**
 Latitude, 18, 186
 Load case, 83–92, 94, 101, 104, 114, 121, 122, 147, 174, 239
- M**
 Magnification, 11, 26, 27, 210, 226
 Main beam, 213, 214, 217–219
 Mathematical, 68, 75, 220, 221, 238
 Matrix, 69, 99, 157
 Maxwell, 13, 14, 17
 Mechatronics, 165, 257
 Membrane, 57, 96, 130, 134, 155
 Millimetre telescope, xviii, xxi, xxviii, 6, 71, 72, 114, 118, 132, 155, 181, 231, 236, 251
- N**
 Natural limit, 65, 66
 Near-field, 167
 Nickel, 139, 171
 Noise, 32, 42, 192, 234
 Nusselt number, 147
 Nutator, 117, 118
- O**
 Octahedron, 65, 67, 71, 76, 77, 136
 Offset antenna, 21, 193–196, 198, 199
 Opening angle, 22, 28, 29, 104
 Optical telescope, 10–13, 15–23, 25, 26, 34, 42, 43, 53, 67, 162, 167, 210, 235
- P**
 Paraboloid, 2, 11, 13, 17, 21, 23, 27, 28, 32–34, 37, 42, 44, 68, 74, 76, 116, 155, 167,

- 186–188, 190–192, 195, 200, 203, 210,
226, 231, 232, 234–236
- Pathlength, 164, 165, 167, 168, 220, 234
- Pedestal, 116, 118, 170, 211
- Photogrammetry, 195, 231
- Planet, 109, 162, 228
- Pointing, 24, 25, 119, 143, 167, 213, 225,
227–231
- Pointing correction, 230
- Pointing model, 124, 167, 229, 230, 257
- Polarisation, 13–15, 194, 210, 235, 236
- Primary reflector, 20, 21, 26, 28, 29, 54, 80, 95,
119, 216, 234, 236
- Pyrex glass, 161
- Q**
- Quadripod, 25, 34, 38, 42, 59, 76, 78, 81, 92,
94, 104, 105, 116, 118, 119, 122–124,
129, 130, 145, 159, 161, 171, 174, 215,
223, 233
- R**
- Radar, 2, 17, 18, 32, 34, 35, 42, 55, 57, 186,
210, 211, 214, 244, 249, 251
- Radiation integral, 220
- Radiation pattern, 24, 211–213, 226, 228, 232
- Radio astronomy, 2, 4, 6, 14, 17, 21, 23, 31–60,
64, 67, 73, 108, 186, 194, 210, 211, 214,
228, 231, 233–235, 237, 244, 247, 254
- Radio telescope, 2, 3, 5–7, 14–25, 29, 32–60,
66, 67, 80, 145, 157, 200, 216, 221, 223,
224, 234–236, 238, 244, 247, 250, 256
- Radome, 57–59, 132–134, 249
- Rail track, 3, 79, 98, 203
- Rayleigh distance, 214
- Reciprocity, 17, 211
- Reflector parabolic, 14, 32, 34, 244
- Reflector spherical, 12, 186, 187, 189
- Refraction, 229, 230
- Refractivity, 230
- Replication, 139, 158
- Resolution, 4, 18, 22, 24, 60, 64, 96, 108, 118,
162, 182, 190, 214, 244, 247, 248, 250,
251, 253
- Reynolds number, 147
- Rigging angle, 131
- Right ascension, 18
- S**
- Sandwich panel, 59
- Satellite, 2, 19, 21, 157, 159, 162, 192–194,
212, 231–234, 256
- Scatter pattern, 218
- Scattering, 215, 217–220
- Secular decrease, 193
- Sensor, 15, 17, 25, 26, 133, 134, 142, 168, 230,
256
- Servo-control, 37, 190, 249
- Shearing interferometer, 156
- Softness, 68
- Solid angle, 213, 214, 232
- Source, 18, 22, 64, 68, 156, 167, 191, 192, 210,
214, 228–231, 244, 247, 248
- Source solid angle, 214
- Space-frame, 134, 162, 168
- Spatial resolution, 232
- Spectrum, 108, 234
- Stainless steel, 65, 66, 69, 75, 89, 90, 97, 137,
157, 159, 171, 173, 174, 180, 191, 202,
215, 247, 248, 250
- Stiffness, 4, 36, 59, 227
- Submillimeter, 6, 108, 154–156, 159–163, 182,
231, 236, 251
- Surface tolerance, 24
- Survival condition, 162
- Synthesis array, 111, 163, 195, 233
- T**
- Taper, 211, 213, 215, 216, 223, 225–227
- Temperature, 5, 119, 130, 138, 147, 149, 175,
215–217, 219, 220, 229, 230, 234, 237,
240, 249, 250
- Template, 96, 97, 156
- Thermal, 5, 6, 23, 34, 54, 55, 66, 103, 108, 113,
114, 117, 118, 126–133, 144–147, 155,
158–160, 164, 173, 175, 177, 178, 210,
215, 231, 234, 249, 250, 255
- Tilt meter, 142
- Transit, 18, 32–36, 55–57, 73, 186, 187, 198
- Transmitter, 14, 17, 19, 42, 167, 213, 228, 233
- Troposphere, 5, 108, 154
- Truss-frame, 111, 112, 116, 118, 155, 158, 159,
197, 247
- Turbulence, 18, 147
- Turning head, 40, 116, 118, 137, 247
- Turret, 47, 49, 50, 111, 118
- U**
- Umbrella, 71, 76, 77, 84, 85, 88–90, 92, 95,
114, 132, 134, 168, 249
- Umbrella support, 95, 114, 249

W

Water vapour, 5, 108, 154, 164

Wave

electromagnetic, 2, 13–15

Wavefront, 25, 211, 220

Westerbork, 76, 95, 96, 223, 237

Wind, 2, 23, 25, 39, 44, 45, 50, 67, 94, 108,

111, 113, 114, 116, 119, 124, 125,

127–129, 131–133, 135, 137, 138, 142,

143, 145–150, 155, 162, 164, 178, 191,

199, 200, 202, 203, 215, 217, 229–231,

240, 247, 249, 250

Y

Yoke, 54, 55, 59, 101, 104, 105, 116, 118, 121,

122, 124, 127, 130, 131, 138, 149,

168–170, 173, 177–179

Z

Zenith angle, 190

Zernike polynomial, 220, 221, 238–240