

Subject Index

- Absorption (*see also* Power, Specific absorption rate) 65–67, 76
 - amplitude coefficient 65
 - biological tissues 76–78, 104
 - theory 76–78
- ACGIH exposure guideline 50
- Acoustic
 - streaming 82
 - window 106, 107
- Admittance network 15
- Ampere's circuital law 4
- Amplitude
 - control 18, 41, 45
 - inversion 37, 39
- Angular frequency 63
- ANSI 127
 - C95.1 exposure guideline 50
- Antenna
 - loop 32
 - probe 32
 - – invasive 37
- Aperture
 - size 17
 - source (*see also* Microstrip, Waveguide applicators) 24, 34–36, 39
- Applicator(s) 118
 - coaxial TEM 19, 46
 - compact 33
 - E-field (*see also* Microstrip, Waveguide applicators) 17–18, 19, 24–27, 36, 40–42
 - – ring electrodes 41
 - – three electrode system 41, 47
 - electric 17–18, 19, 24–27, 36, 40–42
 - – electrically small 40
 - evaluation 131
 - H-field (*see also* H-field) 17, 24, 27–30, 36, 39, 42–44, 47
 - intracavitary 110–111
 - magnetic (*see also* Magnetic) 17, 24, 27–30, 36, 39, 40, 42–44
 - microstrip 24, 33–34, 40
 - radiative 24, 30–34, 35, 36, 40, 44–47
 - scanned 40
- Array(s) (*see also* Electrical focusing and scanning) 36–40
 - annular 38, 39, 44–46
 - conformable 18, 40
 - cylindrical segmented 19, 46
 - of dipoles 39, 46
 - linear 39
 - of microstrip spiral applicators 39
 - phased 37–39, 46
 - planar 37–38
 - quasi planar 21, 40
 - segmented cylindrical 46–47
 - semi circular 39
 - semi elliptical 39
 - with large effective field size 39–40
- Aspect ratio 32
- Attenuation
 - amplitude coefficient 78
 - biological tissues 78–79
 - constant 8
 - theory 65–66
- Backing of a transducer 85
- Bessel function model (*see* Model)
- Bioheat equation 19, 44
- Bio-heat-transfer-equation 76
- Biological effects 80–83
 - blood flow statis 81
 - cavitation 80, 82
 - mechanical 80, 81
 - non thermal 82, 83
 - RF/microwave fields 47–49
 - thermal 81
- Biot-Savart law 4
- Block model (*see* Model)
- Blood
 - brain barrier 49
 - flow 97, 100
 - perfusion 20, 24, 76, 97, 100
- Bolus 17, 24, 25, 27, 32, 34, 37–39, 44, 46
- Bone heating 104, 105
- Boundary
 - conditions 9, 25, 28
 - element method 41
- Brain tumors 103, 106–107
- Calorimetry 89
- Capacitive
 - electrodes 17, 19, 24–27, 36, 40–42, 47
 - ring electrodes 41
 - three electrode system 41, 47
- Carcinogenesis 48
- Cardiovascular system 49
- Cataractogenesis 49
- Cavitation 82
 - stable 82
 - threshold 82
 - transient 82
- Chemotherapy 83
- Coaxial probe 13
- Coherent system 21, 36–37, 40
- Coils (*see* Applicators, H-field, Magnetic, Scanned)
- Conduction current 5
- Conductivity 7
- Conjugate phase 37, 39
- Constructive interference 37
- Control 100, 109–110
 - phase 18, 41, 45
- Convergent lens applicator 38
- Cooling 26, 41, 118
- Coulomb's law 3
- Coupling 105, 117, 118
 - antenna 32
 - bolus 117, 118, 132
 - efficiency 135
 - system 118
- Curie temperature 83, 84
- Current loop 17, 19
- Cut-off frequency 31, 32
- Cylindrical
 - segmented array (*see* Array)
 - target 38
 - waves 14
- Diathermy 1, 2
 - microwave 2
 - shortwave 2
- Dielectric
 - loaded applicator 32, 33
 - polarisation 5, 6
 - – current 6
 - – field 6
 - properties of tissues 5–7
- DIN 57848 exposure guideline 51
- Dipole
 - array of 39
 - electric 16
 - magnetic 16, 17, 28, 29, 40
 - tapered 38
- Effective field size 36, 39
- Effects
 - athermal 48
 - cellular 48
 - chromosomal 48

- Effects
 - macromolecular 48
 - teratogenic 48
- Efficiency 84
- Electromagnetic 127
 - hazard 137
 - leakage 137
 - safety 137
 - shielding 127
- Electric
 - charge 3
 - dipole 16
 - field 28, 31
 - time-invariant 3–4
 - time-varying 4–5
 - susceptibility 6
- Electrical
 - focusing and scanning 69, 72–74
 - properties of tissues 5, 7
 - safety 51
- Endocrine system 49
- Enzymes 48
- Exposure guidelines 49–50, 51
- Eye tumors 95
- Faraday's law 4
- Field(s)
 - equivalence theorem 14, 35
 - fringing 25, 32
 - multiple ultrasonic 95, 96
 - near 17
 - coupling 16, 17
 - pulsed 49
 - quasi-static 5, 17
 - stray 17, 51
 - ultrasonic (*see* Ultrasonic fields)
- Finite difference frequency domain (FDFD) method 15
- Finite difference time domain (FDTD) method 15
- Finite element method 16
- Fourier transform 14, 34
 - moment method 15
- Full-wave operation (*see* Wave)
- Galerkin's method 14, 15
- Gas interfaces 105
- Gauss's law 4
- Gaussian
 - beam model 14
 - function 34
- Haematopoietic system 49–50
- Harmonic generation 67
- Half-power (*see* Power)
- Half-wave (*see* Wave)
- Helix 19, 43, 47
- H-field applicators 17, 24, 27–30, 36, 39, 42–44, 47
 - coil(s)
 - coaxial 42–43, 47
 - concentric 42, 47
 - helical 19, 43, 47
 - pancake 17, 27–29, 41
 - distributed current 29, 30–44
 - toroidal 43–44
- Huggen's principle 67
- Hydrophones 87
- Hyperthermia
 - deep body (*see* Hyperthermia, regional)
 - high temperature 111
 - local 17–18, 24–40
 - regional 18–19, 22, 40–47
 - superficial (*see* Hyperthermia, local)
- Image 102–103
- Immune system 49–50
- Impedance 29
 - characteristic 23, 32, 33
 - biological tissues 79
 - theory 65
- input 23, 27
- intrinsic 8
- matching 17, 22–24
- electric 86
- mechanical 86
- network 15
- wave 8
- Incoherent system 21, 36–37, 40
- Induction coils (*see* Applicators, magnetic)
- IRPA exposure guideline 50
- ISM frequencies 127
- Laplace equation 25
- Lead zirconate titanate 84
- Lenses 70–71
- Linear basis functions 15
- Loss tangent 6, 17
- Magnetic
 - applicators 17, 24, 27–30, 36, 39, 40, 42–44
 - coils
 - coaxial 42–43, 47
 - concentric 42, 47
 - helical 19, 43, 47
 - pancake 17, 27–29, 41
 - distributed current 29–30, 44
 - toroidal 43–44
 - dipole 16, 17, 28, 29, 40
 - fields (*see also* Fields)
 - time invariant magnetic 4
 - time varying magnetic 4–5
 - vector potential 28
- Magnetisation 6
- Maxwell's equations
 - differential forms of 5, 7
 - integral forms of 4
- Microstrip
 - applicator 24, 33–34, 41
 - patch 34
 - ring 34
 - spiral 34, 40
 - transmission line 33
- Mitochondria structure and function 48
- Mode
 - common 41
 - differential 41
 - TE mode 31, 34, 35, 40
- Model(s)
 - analytical 13–14
 - Bessel function 38
 - block 15, 45
 - numerical 14–16
 - Gaussian beam (*see* Gaussian)
 - three dimensional of man 41, 42, 45
- Moment method 14–15, 44
 - Fourier transform 15
- Near field (*see* Field)
- Nervous system 49
- NRPB exposure guideline 51
- Optical detection methods 90
- Pancake coils (*see* Applicators, H-field, Magnetic)
- Particle
 - acceleration 63
 - displacement amplitude 63
 - pressure 65
 - velocity 63
- Period of wave (*see* Wave)
- Penetration 17, 42
 - depth 34–36, 40
 - effective 35–36, 39
 - for cooling 26
- Permittivity
 - complex
 - imaginary part 6, 7
 - real part 6, 7, 34
 - relative 6–7
- Phantom
 - materials 9–13
 - brain
 - gel type 13
 - bone
 - castable solid type 12
 - liquid type 12
 - fat
 - castable solid type 12
 - dough type 12
 - liquid type 12
 - lung 39
 - muscle 37–40, 43
 - gel type 10, 11
 - liquid type 11, 13
 - polyacrylamide 12
 - standard phantoms 10
 - ultrasonic 92–93
- Phase 63
 - angle 37
 - conjugation 37, 39
 - constant 8, 31
 - control 18, 41, 45
- Piezoelectric 83–84
 - effect 83
 - materials 83–84
- Pitch angle 43
- Polyvinylidene fluoride 84
- Power 117
 - absorption 8, 9, 17, 27
 - accuracy 127

- coupling 118
- evaluation 127
- generator 118
- half-power
 - penetration 35
 - width 37
- line loss 130
- net 130
- requirements 19, 24
- transmission 130
- Poynting vector 8
- Propagation
 - constant 8, 31
 - non linear
 - biological tissues 79–80, 107–108
 - theory 66, 67
- Pressure 64–66
- Pulse functions 14
- Pulsed fields 49
- PZT (*see* Lead zirconate titanite)

- Q-Factor** 85–86
- Quality assessment 120
- Quartz 83, 84

- Radiation**
 - force measurement 87–89
 - therapy 83
- Reflection
 - coefficient 9
 - theory 65
 - tissue interfaces 104–105
- Refraction 65, 76
- Resonance
 - bubble 82
 - transducers 84–85

- Safety procedures 50–51
- SAR (*see* Specific absorption rate)
- Scanned
 - applicators (*see* Applicators)
 - coils 43
- Scanning 96–103
 - electrical 97
 - mechanical 97, 101–103
 - pattern 98
 - speed 97
- Scattering 65–66, 75
- Schlieren visualization 90
- Shear wave (*see* Wave)
- Shock 67
- Short wave current (*see* Wave)
- Simple harmonic motion 63
- Skin cooling (*see* Cooling)
- Somatic cells 48
- Specific absorption rate (SAR) 3, 11, 13, 20, 21, 24, 26, 28, 29, 34–36, 38–42, 44–46, 48, 128
 - pattern 131, 132
 - reproducibility 132
- Standing waves (*see* Wave)
- Streaming 82
- Stray fields (*see* Fields)
- Stub tuner 24

- Tan δ** (*see* Loss tangent)
- TEM
 - coaxial TEM applicator 19, 46
 - wave 33
- TE mode 31, 34, 35, 40
- Temperature 117
 - accuracy 118
 - calibration 124
 - linear mapping 124
 - moisture artifact 126
 - smearing 124
- Tissue interfaces 104–106
- Three dimensional model of man 41, 42, 45
- Thermography 131
- Thermometry 117
 - accuracy 120, 121
 - artifacts 123
 - evaluations 118
 - perturbations 123
 - precision 120, 121
 - response time 120, 122
 - stability 120, 121
 - system 117, 118
- Transducers
 - backing of 85
 - spherically curved 69–70
 - ultrasound 84–87
- Treatment planning 108

- Ultrasonic fields**
 - calculations 74–76
 - focused 68–73
 - theory 67–76
 - unfocused 67–68
- Ultrasound field calibration
 - hydrophones 87
 - optical 90
 - radiation force 87–89
 - thermal methods 89–90

- Vector potential**
 - magnetic 28
- Velocity
 - biological materials 76
 - particle 63
 - wave 63

- Wave**
 - equation 63
 - full-wave operation 43
 - half-wave operation 43
 - impedance 8
 - length 8, 16, 39, 63
 - longitudinal 62
 - number 63
 - period 63
 - short wave current 2
 - shear 79
 - standing 81
 - ratio 23, 24
 - TEM 33
 - transverse 62, 79
 - velocity 63
- Waveguide applicator 17, 30, 40
 - convergent lens 33, 40
 - dielectric slab loaded 33, 40
 - dual ridge 33, 40
 - rectangular 31–32, 34, 35, 36, 39
 - single ridge 32–33, 36, 40, 44
- Weighting functions 14