

Index

A

Acetylcholine (ACh), 110, 121
Acidosis, 110
Action potentials (APs), 83, 84
Adenosine triphosphate (ATP), 114
Admissible models, 11
Advanced Spaceborne Thermal Emission
and Reflection Radiometer
(ASTER), 47
Afferent fibers, 110
Alpha adrenoreceptors, 110
Ampère's law, 62
Amplitude modulation (AM), 64
Anisotropy, 118
Appleton layer, 64
Asthenosphere, 3
Astrophysics, 197
Atrionodal (AN), 118
Atrioventricular (AV) node, 110
Atrium, 105–107, 118, 122, 126
Automaticity, 117
Automaticity of the heart, 106
Autonomic nervous system (ANS), 111, 118
Autorhythmicity, 115

B

Balloon complex, 45–47
Baroreceptors, 111
Beta-adrenergic receptors, 111
Big Bear earthquake, 8
Bipolar leads, 124
Blood pressure, 217
Brain
AP, 83, 84

cerebellum, 77
EEG approach, 70
EEG generation, 84–86
EEG measurements, 71
electromagnetic (EM) block, 70
electro-neurophysiology, 71
EM signals, 70
investigation, 71
medical applications, 71
neuroglia, 71
neurons (*see* Neurons)
operational control, 70
PDEs, 69
structures
cellular, 72
cerebrum, 74, 75
CNS, 73
cognitive maturity, 77
corpus callosum, 74
cortex, 73–75, 77
cosmic weather, 72
frontal lobes, 74, 77, 79
and functions, 72, 77–79, 81
left and right hemispheres, 77
limbic system, 73, 76, 77
lobes and functions, 81
macroscopic, 72, 79
neocortex, 77
nerve cells, 77
occipital and parietal lobe, 75
right and left sides, 80
sasal ganglia, 76
temporal lobe, 76
transformation, EEG signals, 70
waves (*see* Brain rhythms)

Brain rhythms

- alpha waves, 86, 87
- amplitude levels, 87
- beta wave, 87
- delta waves, 86, 87
- frequencies, 88
- frequency bands, 86
- theta waves, 86

Burgers equation, 218

C

Ca²⁺ ATPase, 111

Cardiac action potential, 114, 115

Cardiac anatomy and physiology

- atria and ventricles, 105
- blood circulation, 106
- cardiomyocytes, 109
- conduction system, 108
- coronary arteries and coronary veins, 106
- depolarization (*see* Depolarization)
- EMF induction, 109
- endocardium, 106
- myocardium, 106
- pericardium, 106
- SA node, 106, 109
- venous blood flows, 105

Cardiac circulation, 107

Cardiac conduction system, 117–119

Cardiac muscle, 114

Cardiac parameters, 130, 132, 133

Cardinality, 11

Cardiomyocytes, 108, 114

Catecholamines, 111, 117

Cauchy–Kovalevskaya type, 172

Central nervous system (CNS), 73

Cerebral cortex, 85

Chemoreceptors, 111

Coefficient of variation (CV), 136

Coherence function (CF), 96, 216

Coherence function values (CFVs), 48, 96

Coherence of brain rhythms, 100, 101

Computational methods, 216

Computed tomography (CT), 11

Controlled source of EM (CSEM) fields, 45

Coronal mass ejection (CME), 65

Coronary arteries, 106

Coronary veins, 106

Co-rotating interaction regions (CIRs), 65

Craton, 4

CTD devices, 49

Curie point, 5

Cyclic adenosine monophosphate (cAMP),
111, 117

Cytosol, 111

D

Deep MTS (DMTS), 3

Depolarization

- atrial, 109, 116, 122, 123, 125, 126
- cardiac tissue, 121
- cardiomyocyte action potential, 116
- heart, 121, 126
- membrane, 108, 117
- myocardium, 109
- pacemaker potential, 115
- spontaneous, 116
- ventricles, 123, 125, 126
- wave, 109

Desmosome, 111

Detection

- seaquake precursors, 42
- Tsunami precursors, 35

Diastolic relaxation, 117

Differential operators, 215

Direct current (DC), 82

Distinctive seismic trace, 29

Distortionless transmission, 216

E

Earthquake (EQ)

- acoustic waves, 2
- computational stage, construction, 2
- deformations, 1, 2
- EM, 2
- geological–geophysical basis, 2
- prognosis, 2

Earth's magnetic field, 62–63

ECG test registration, 133

EEG recordings, 93, 94

EEG signal, 84–86

EEG time series

- electrical potentials, cerebral cortex, 92
- moderate geomagnetic storms, 92
- oscillations, 99
- sets, 96, 100
- theta rhythm oscillations, 94

Efferent fibers, 112

Einthoven's triangle, 124–126

Elasticity and magnetic diffusion, 21

Electrical conductivity, 2–5

Electrical energy distribution, 92

Electrocardiogram (ECG), 92, 109, 130, 217

- cardiac cycle, 121, 122, 126
- deflections, 123
- dipole, 121
- electrodes, 123
- heart's electrical axis, 125
- lead positions, 124
- parameters, 123

- P wave, 122, 125
 - QRS complex, 123, 126
 - Q wave, 123
 - R wave, 123
 - skeletal muscles, 121
 - S wave, 123
 - T wave, 123
 - U wave, 123
 - voltage vs. time, 122
 - Electrocardiographic waveform, 110
 - Electrochemical transfer, 108
 - Electroencephalography (EEG), 92, 93, 129, 216
 - generation, 73
 - geophysical processes, 82
 - higher spatial resolution, 71
 - invasive methods, 70
 - measurements, 70, 71
 - mechanisms, 82
 - medical applications, 70
 - quantitative investigation, 70
 - signals, 82
 - temporal resolution, 71
 - theory, 82
 - Electromagnetic (EM) processes, 92
 - Electromagnetic (EM) signals
 - components, 6
 - earthquake preparation processes, 10
 - electro-telluro-gram, 7
 - geothermal precursors, 9
 - ionosphere and magnetosphere, 7, 9
 - lithosphere domain, 9
 - magnetic and seismic recordings, 8
 - magnetic observation, 6, 7
 - mechanism, 1
 - nonlithospheric origin, 9
 - oscillations, 9
 - photoamplifier, 6
 - seismograms, 6
 - ULF, 5, 7
 - Electromagnetic (EM) waves, 140
 - Electromagnetic field (EMF), 36, 109
 - Electromechanical (EM) process, 215
 - Electro-neurophysiological theta rhythm, 93
 - Electro-neurophysiology, 71, 95, 96
 - EM field propagation, 44
 - Endocardium, 106
 - Energy inequalities, 171
 - Epicenter area
 - computed magnetic location, 25
 - emission, earth's surface, 16
 - future earthquake, 31
 - Excitation contraction coupling, 116
 - Executive functions, 79
- F**
- Field equations, 19, 20
 - Field interaction theory, 216
 - Finite difference method, 171
 - Fluid mechanics, 196
 - Frank–Starling mechanism, 117
 - Functional magnetic resonance imaging (fMRI), 71
- G**
- Galerkin basis, 171
 - Galerkin method, 175, 187–192
 - Geodynamo, 62
 - Geomagnetic planetary index, 64–67
 - Geomagnetic storms, 64–67, 129, 130, 132–137, 216
 - brain, 93
 - characteristics of influence, 92
 - EEG time series, 92
 - electrical potentials, cerebral cortex, 94
 - encephalographic (EEG) records, 94
 - influence, 98
 - medical estimations, 93
 - penetration of the EM field, 95
 - Global Positioning System (GPS), 35, 64
 - G-protein, 112
 - Gravimeter, 43
 - Green function, 174
- H**
- Heart innervation, 119–121
 - Heart rate variability (HRV), 132
 - Heat transfer processes, 21
 - Helio-geophysical dynamics, 92
 - Hook–Duhamel–Neumann law, 160, 187
 - Human brain, 92
 - Huygens' principle, 174
 - Hydrodynamic theory, 195, 196
- I**
- Inhibitory postsynaptic potential (IPSP), 82
 - Inotropic effect, 112
 - Integro-differential system, 217
 - Interaction of physical fields of different natures, 171, 172, 175
 - Intercalated disks, 114
 - International Association of Geomagnetism and Aeronomy (IAGA), 66
 - Inverse problems, 10–12
 - Ionosphere, 64

K

Kallikrein–kinin system, 112
 Kennely–Heaviside layer, 64
 Kernels of relaxation, 148, 150, 151

L

Landers earthquake, 8
 Lithosphere domain, 17
 Locating operator, 24, 30
 Loma Prieta earthquake, 4
 Lorentz force, 62
 Lorentz formula, 157
 Lorentz transformation, 154, 155
 Low-frequency/high-frequency (LF/HF) ratio, 135, 137
 Low-resistivity structures (LRS)
 DMTS, 3
 earthquake epicenters, 4
 electrical conductivity, 3
 geothermal gradient, 5
 graphitization and mineralized fluids, 5
 low-ohmic ferromagnetic minerals, 5
 magnetometer array, 4
 MHD, 2
 MTS, 2–5
 petro-physics, 5
 seismic and magneto-telluric models, 4
 seismo-EM emission, 2
 tectonic regions, 2

M

Magnetic encephalography (MEG), 71
 Magnetic induction emission, 31
 Magnetic intensity, 22
 Magnetic location
 computed, 24–27
 epicenter area, 16
 seismo-electromagnetic (seismo-EM) phenomenon, 16
 Magnetic location of a possible earthquake epicenter area (MLPEEA)
 computed, 24, 26, 27
 seismo-electromagnetic phenomenon, 32
 seismo-EM phenomenon, 17
 string–diffusion model, 22
 Magnetic precursors, 38
 Magnetic resonance imaging (MRI), 71
 Magnetic storms (MSs), 91, 93, 95, 216
 Magneto-hydrodynamic (MHD), 2, 3, 65
 Magneto-hydrodynamic waves, 146
 Magnetometer, 43

Magnetosphere, 62–63
 Magneto-telluric soundings (MTS), 2–5
 Magneto-thermo-elasticity (MTE), 140, 175
 Galerkin approximation, 188–192
 initial boundary value problem, 187, 188
 theory, 16, 52, 215
 Magneto-thermo-viscoelasticity
 Cauchy tensor of deformation, 153
 dielectric permeability, 155
 dynamical theory, 152
 EM field, 154, 156
 EM force, 157
 four-component equation, 159
 linear theory, 152
 magnetic field, 156
 nonequilibrium thermodynamics, 152
 nonuniform medium
 anisotropic models, 160
 conjugation field, 164
 hyperbolic operator, 161
 magnetic and electrical permeability, 162
 nonstationary parameters, 160
 precursors, 160
 slow motion, 164
 surface charges and currents, 162
 tangential components
 of intensities, 163
 vector and scalar lines, 161
 ohmic dissipation, 158
 precursory physics, 153
 preliminary estimations, 154
 relaxation kernels, 159
 S.-D. systems, 159
 slowly moving medium, 155
 temperature field, 153
 2D system, 165–168
 weak electrical and magnetic polarization, 157
 Marine magneto-telluric (MMT) sounding, 44
 Mathematical model
 magneto-thermo-elasticity, 16
 MLPEEA, 16, 17
 seismo-EM phenomenon, 17
 seismo-hydro-electromagnetic-temperature geophysical field interaction, 50
 SHEMTI model, 36
 string–diffusion (*see* String–diffusion)
 tsunami precursors detection system, 36
 Maxwell's equation, 155, 156, 158
 Mean coherence, 102
 Membrane permeability, 114

Model seismic submarine excitation, computed signals, 37, 38, 40, 41
 Modified Burgers equation, 196, 213
 Muscarinic receptors, 112
 Myocardia, 109
 Myocardium, 106
 Myocyte, 114, 117, 118, 123
 Myosin, 117

N

National Oceanic and Atmospheric Administration (NOAA), 65
 Navier–Stokes equation, 145, 146, 148
 Neurons
 axon, 82
 cell, 82
 dendrites, 82
 EEG, 82
 functions, 82
 membrane potential, 83
 Neurotransmitter, 110
 Newton–Leibniz formula, 180
 Nodal (N), 118
 Nodal–His (NH), 118
 Nonlinear magneto-thermo-elasticity system, 217
 Nonstationary flow process, 196
 Nucleus tractus solitarius (NTS), 119

O

Ohm's law, 155
 Ordinary differential equations (ODEs), 198
 Ore genesis, 4

P

Pacemaker cells, 114, 116
 Partial differential equations (PDEs), 50, 62, 69, 140, 172, 197, 217
 Peltier effect, 153
 Pericardium, 106
 Peripheral nervous system (PNS), 73
 Petrophysics, 11
 Phosphorylation of calcium membrane channels, 112
 Positron emission tomography (PET), 71
 Postganglionic efferent fibers, 119
 Proofreading test (PRT), 130
 Pulmonary vein, 105
 Purkinje cells, 112, 114, 118

Q

Quantitative electro-neurophysiological mechanism, 217

R

Radio techniques, 48
 Radio waves, 64
 Radon transform, 11
 Rankine–Hugoniot conditions, 199
 Refractory phase, 112
 Repolarization
 atrial and ventricular cells, 110, 121–123
 calcium channels, 115
 heart, 121
 intracellular calcium concentrations, 117
 myocardium, 109
 potassium permeability, 116
 Purkinje system, 123
 sodium channels, 115
 wave, 126
 Respiratory rate, 217
 Respiratory rhythm recording, 131, 132
 Rhythms of brain bioelectrical oscillations, 96, 98, 101, 102
 Rolling wave (rw-solution), 196, 197, 199, 202–204, 212
 R-R interval recording, 131, 132
 Ryanodine receptors, 113

S

Saint Venant model, 213
 Sarcolemma, 114
 Sarcolemmal/sarcoplasmic reticulum junctions, 117
 Sarcoplasmic reticulum, 113
 Satellite complex, 47–48
 Satellite electromagnetic induction methods, 48
 Seabed station, 42
 Seafloor complex, 42
 batteries, 45
 CSEM soundings, 45
 EM field propagation, 44
 hydro-acoustic signal, 44
 hydrodynamic block, 43
 magnetometers, 43, 45
 MMT sounding, 44
 reasonable solution, 43
 seaquake–tsunami process, 44
 short hydrodynamic waves, 44
 thermometry block, 43
 transmission via fiber-optic cabling, 45

- Seaquakes, 36
 - Sea surface complex, 45
 - Seismically active lithospheric zones
 - LRS (*see* Low-resistivity structures (LRS))
 - Seismic disturbances, stationary fields, 22
 - Seismic magnetic components, 40
 - Seismic wave, 28, 29
 - Seismo-EM interaction
 - effect, 28, 31
 - energy, 23
 - heat transfer processes, 21
 - magneto-thermo-elasticity, 16
 - Seismo-EM transformer, 17, 26, 31, 32
 - Seismo-EM-temperature interaction, 20
 - Seismo-EM-thermal interaction (SEMTI)
 - process, 17, 36, 37
 - initial boundary value problem, 53–55
 - string–diffusion structure
 - dynamic theory of elasticity, 50
 - electrical conductivity, 52
 - interaction operator, 52
 - magnetic permeability, 51
 - seismic EM generation, 51
 - seismo-EM-thermal interaction, 53
 - seismo-hydro-EM-thermal interaction, 53
 - shallow water, 53
 - 3D model, 53
 - tsunami precursor formation, 50
 - Seismo-hydro-EM interaction, 54
 - Seismo-hydro-EM-temperature interaction
 - approach, 41
 - seismo-hydro-EM-thermal interaction, 53
 - Seismo-magnetic locating system, 31
 - Seismometers, 43
 - Self-similarity, 196, 213, 218
 - Self-similar solutions, 196–198, 213
 - Semi-implicit finite difference approximation
 - grid approximation, 176–187
 - inequality, 184–186
 - initial boundary value problem, 175, 176
 - Shallow water, 53, 54, 57
 - Shock rw-solution, 199
 - Shock waves, 196, 202–205
 - Sinoatrial (SA) node, 106, 109, 113
 - Solar wind, 61
 - Storm influence, human brain EM processes, 93, 94
 - Storm recordings, 93
 - String–diffusion, 57
 - mathematical model of SEMTI process
 - computed MLP EEA, 24–26
 - field equations, 19–22
 - initial and boundary value conditions, 22, 23
 - locating operators, 29, 30
 - model medium, 17–19
 - seismo-EM interaction, effect, 28, 31
 - operators, 21
 - partial differential equations (PDEs), 17
 - String–diffusion (S.-D.) phenomena, 141
 - String–diffusion systems of equations (SDSE), 175, 217
 - Cauchy problem, 174
 - classical theory of elasticity, 143
 - conservative processes, 140, 142
 - constant coefficients, 174
 - discrete analogs, 171
 - dissipation, 142
 - dissipative media, 174
 - earthquake preparation zone, 140
 - explicit grid approximation, 175
 - finite difference and Galerkin approximations, 171
 - finite difference energy estimations, 174
 - geophysical fields, 143
 - grid scheme, 175
 - heat conductivity equation, 172
 - hyperbolic operator of first differential order, 144–147
 - hyperbolic/parabolic type, 172
 - ideal and nonideal types, 140
 - ill-posed problems, 141
 - initial boundary value problem, 140, 141
 - Liouville type, 174
 - magnetic and thermal diffusion, 142
 - mathematical models, 141
 - MTE theory (*see* Magneto-thermo-viscoelasticity)
 - noninteracting fields, 141
 - nonmechanical equation, 143
 - nonstationary magnetic and temperature fields, 142
 - notations, 139
 - operator coefficients, 140
 - PDEs, 172
 - string component, 174
 - thermo-elasticity, 172, 173
 - thermo-viscoelasticity, 147–152
 - vector fields, 140
 - Sympathetic nervous system, 113
 - Synthetic aperture radar (SAR), 47
- T**
- Temperature oscillations, 41
 - Tetanic contraction, 113
 - Thermo-elasticity, 140, 172, 173
 - Thermo-viscoelasticity, 147–152
 - Three-dimensional (3D) body, 11

3D nonlinear system of PDEs, 187–192
 Threshold parameter value, 216
 Transmission via fiber-optic cabling, 45
 Tsunami precursors
 computed seismic, 37
 description, 36
 detection system, 36 (*see also* Tsunami precursors detection (TSUNPREDET) system)
 physical parameters of the medium, 56
 Tsunami precursors detection (TSUNPREDET) system
 balloon complex, 45–47
 block scheme, 39
 characteristic, 39, 41, 42
 configuration, 48, 49
 satellite complex, 47–48
 seafloor complex (*see* Seafloor complex)
 sea surface complex, 45
 Tsunami precursors detection system, 216
 2D string–diffusion model, 57
 Typing of differential equations, 148

U

Ultralow frequency (ULF) EM signals, 5, 9
 Underwater earthquakes, 35
 Universal time (UT), 66

V

Vagal stimulation, 113
 Vanishing viscosity, 195–213, 217, 218
 breakpoints, 201
 characteristics, 196
 hydro-technic constructions, 197
 nonlinear hydrodynamic component, 195
 nonviscous solutions, 199, 203, 209, 210
 parabolic degeneration, 198
 parabolic equation, 198
 PDEs, 197, 200
 properties, 200
 rw-solution, 196, 197, 199, 202–204, 212
 second-order derivatives, 196
 seismo-hydro-electromagnetics, 195
 self-similarity, 196
 shock rw-solution, 199
 shock waves, 196, 204, 205
 spatial–temporal structure, 200, 213
 theorem, 205–212
 viscous solutions, 196, 209, 210
 Venous blood flows, 105
 Ventricles, 105–107, 109, 113, 116, 118–120, 122, 123, 126
 Ventricular myocytes, 108
 Verapamil, 113
 Very-high-frequency (VHF) earthquake precursors, 42