

Index

A

ABB SoFT 254
 Alternative Transients Program (ATP) 400
 alternative transients program–electromagnetic transients program (ATP-EMTP) 323
 anhysteretic curve 212
 artificial neural network (ANN) 468
 Australia Snowy Mountains scheme 159

B

Basic Impulse Insulation Level (BIL) 440
 BCTRAN model 216, 218, 222
 bi-linear transformation 350, 353, 372
 Black-box modelling 81, 260
 boundary conditions 6-7, 11, 13, 15, 23, 25, 55, 70, 127, 136, 146, 468, 524, 530
 Busbars 361

C

Cable Modelling 306
 Capacitive Voltage Transformer (CVT) 222-223
 Chinese FRA standard 468
 CIGRE 377
 circuit breakers (CB) 322
 Continuous disk winding 262, 265
 Corona effects 406
 Creepage 445-446, 450
 current injection (CIJ) 326, 334

D

DC Resistance 3, 50, 270
 De-Energized Tap Changers (DETC) 450
 dielectric system 272
 digital oscilloscope (DSO) 534
 digital signal processing 114, 155, 157, 181, 369
 disk winding 127-135, 137, 262, 265-266, 320, 445-446

distributed continuous-parameter model 523
 double-circuit transmission lines 197
 Dual-State Inductance 201-203

E

eddy current loss 50, 214
 eigenvalues 19, 21, 65, 83, 92, 94, 241, 244, 247, 253, 258-260, 316-317
 eigenvalue theory 19-20
 Electricity De France (EDF) 112
 electromagnetic theory 2-3, 44, 425
 electromagnetic transients program (EMTP) 127, 377, 400
 electromechanical torque 384

F

Fast Fourier Transform (FFT) 459, 502
 Fast VF (FVF) 257
 feeder bays 431, 435
 ferroresonance 185
 ferroresonance operating point 185, 188-189, 207, 209
 Finite Difference Method. 102
 Finite Element Method (FEM) 102, 242, 268
 Finite Impulse Response (FIR) 536
 Foster's reactance theorem 15, 17
 four-terminal parameter 23-24
 frequency-dependent 3, 25-26, 44, 47, 50, 53-54, 59, 64, 78-80, 86-87, 90, 101, 105, 109, 118-119, 127, 151, 157, 165-166, 210, 212, 214, 240, 252, 271, 280-282, 286-287, 300, 306, 311, 316-317, 319, 321, 328, 333, 339-342, 346, 398, 408-409, 421, 423-425, 427, 437, 484, 527
 Frequency-Dependent Parameters 78
 Frequency response analysis (FRA) 102, 107, 313, 321, 325, 328, 337, 366, 484

G

gas insulated substations (GIS) 240, 491
generator stator windings 143, 151-152, 154-156,
159, 164, 167, 169, 171, 175, 180-181, 343,
368
genetic algorithms (GA) 536
ground wire (GW) 35, 40, 42

H

high frequency current transformers (HFCT) 174,
522, 534
High frequency surges 45-47
high tension (HT) 128
high voltage (HV) 458, 489
HV motors 175, 343-344, 346, 350

I

impulse frequency response analysis (IFRA) 458
induction machine transient model 384
Infinite Impulse Response (IIR) 536
initial voltage distribution 48, 50, 67-69, 71, 78,
115, 262, 267, 387, 419-420
insulation coordination 104, 106, 343, 398-399,
435-436
Interleaved winding 112, 118-120, 122-123, 125-
126, 128-129, 136-137, 139, 141, 262-264,
266-267, 526-527, 535-536
Internally shielded winding 267
Internal models 48, 50, 52, 101, 239-240, 313, 417
International Electrotechnical Commission (IEC)
377
interturn voltages 47, 50, 108, 394-395

K

Kirchhoff's law 2

L

Lattice Diagram Method 34
Layer winding 123-124, 267-268, 439-440, 445-
446, 449
Levenberg-Marguardt algorithm 349
Lightning discharges 46, 239-240, 399-401, 404,
406-407, 411, 413, 424-425, 430
Lightning Location System (LLS) 401
local resonance 175
low voltage (LV) 456
lumped-parameter circuits 1, 63, 79
Lumped-Parameter Models" 58

M

magnetic-levitation (MAGLEV) 35, 41
Maxwell's wave equations 10
mechanical torque 379, 384
metal-oxide arresters (MOA) 415
modal theory 1-2, 18-21, 110
Modal Vector Fitting (MVF) 257
multiconductor transmission line (MTL) 53, 242,
523, 529-530, 537
multi-input multi-output (MIMO) 536

N

nanocoulombs (nC) 489
neutral terminal (NT) 128
n-port reciprocal network 360

O

Ohm's Law 21, 30
On-Load Tap Changers (OLTC) 450
Orthonormal VF (OVF) 257

P

partial discharge (PD) 111, 134, 143, 169, 487
Passivity Enforcement 258-259, 305-306, 316
phase velocity 9-10
picocoulombs (pC) 489
Power stations 399-400, 402, 413
power transformer 89, 102-105, 109, 143, 218, 221-
223, 235, 267, 313-314, 325, 368, 438-439,
447, 449-452, 464, 484-486, 493-494, 497,
501, 505, 508, 518-520, 538
propagation constant 1-2, 11, 20, 24-27, 29, 55, 524,
532
propagation time 15, 38
Proximity Effect 270-271, 280
Pulse propagation 151, 154-155, 167, 180-181, 522,
539

Q

Quasi-Newton method 346, 349, 355

R

R-C filters 453
Relaxed VF (RVF) 257
Repetitive Surge Oscillator (RSO-generator) 448
resonance analysis 90-95
resonance condition 15-17, 186

rise of recovery voltage (RRRV) 322

S

saturable reactor 223, 225-226, 229-234
 saturable transformer component 214-215, 218, 220
 sectional winding transfer function (SWTF) 536
 Short-circuited inductance 338
 short-circuited line 13-16, 30, 32
 Signal Attenuation 506, 537
 Signal Velocity 505
 Silicone Carbide 451
 single-phase transmission line (STL) 54, 65, 242, 247
 single-phase winding 82, 251
 sinusoidal voltages 120, 147, 152
 Skin Effect 3, 49, 51, 79, 270, 280, 325, 331, 334, 379
 slip-ring end (SRE) 163
 Standing wave approach 73-74
 State-Space Model 256
 subharmonics 209
 SUMER 127
 Surge arresters 186, 233, 302, 398-399, 401, 406, 413, 415, 423-424, 428, 430-431, 433-437, 448, 451-453
 swept frequency response analysis (SFRA) 458
 symmetrical component transformation 2
 synchronous machine model 377, 383-384, 386

T

Temporary overvoltages (TOV) 416
 Terminal models 48, 79, 81, 87, 89, 101, 241, 251, 315, 417, 419
 Terminal resonance 90, 95
 The Institute of Electrical and Electronics Engineers (IEEE) 461
 Thevenin's theorem 30, 32-33
 time differences of arrival (TDOA) 492
 Tower footings 402, 411
 transformer limited fault (TLF) 321-322

Transformer Modelling 47, 72, 86, 89, 91, 110, 239, 257, 304, 306, 320, 506
 transformer windings 49-50, 54, 58, 62, 67, 72, 101, 103, 105, 107-111, 113, 115, 119-123, 125, 128, 130, 134, 136, 141-142, 180, 186, 195, 216, 239-241, 260, 273, 275-276, 288, 290, 293, 296, 303, 313-315, 317-320, 328, 338, 364, 368-369, 417, 428, 455-457, 469, 479, 484-485, 518, 521, 523, 529, 538-539
 transient conditions 47, 50, 52, 102, 165, 187-189
 transient network analyser (TNA) 152, 183
 Transient recovery voltages (TRV) 322
 transient voltage waveshapes 101
 transient waveshapes 444, 452
 traveling wave 7, 10, 17, 21, 28, 30-31, 33-35, 131, 148, 157, 183, 536
 Travelling wave approach 73-74
 travelling wave method 171, 530, 537
 Travelling wave propagation 167, 181, 367
 turbine end (TE) 163

U

ultra-high frequency (UHF) 487

V

vacuum circuit breaker (VCB) 293
 Vector Fitting 86, 104, 256-257, 288, 305-306, 315-317
 vector network analyzer (VNA) 252
 voltage transformer (VT) 185, 193, 221

W

Weidmann-curves 450

Z

zero sequence flux 211, 217
 zero-sequence voltage 225
 z-transform model 110, 343, 346, 353-355, 358-360, 363, 366-367, 369