Index

a

Airy equation 18, 34, 41
Alfvén resonance 10, 12, 17, 41, 133, 137
  back influence of Alfvén wave to FMS field 146, 153
  in a dipole magnetosphere 149
  energy dissipation in the resonance region 19
  resonance point 13, 16, 87, 89
Alfvén waves
  absorption in the ionosphere 213
  boundary conditions at the ionosphere 120, 128
  kinetic 41
  m≫1
    excitation by a localised monochromatic source 275
    excitation by a localised pulse source 282
    excitation by a stochastic source 241
    excitation by HF radar 280
    pulse excitation 253
    transverse spatial structure 215, 222
  m∼1
    excitation by broadband sources 158
    excitation by FMS wave packet 161
    excitation by pulse sources 21, 160
    excitation by stochastic sources 162
  oscillation modes
    poloidal 203
    toroidal, m≫1 203
    toroidal, m∼1 141
  oscillations field on the ground 130, 226
  polarisation spectral splitting 204
  transverse dispersion 7, 37
    due to kinetic effects 349
    due to the field line curvature 234
approximation
  of deep potential well 47
  of geometrical optics xlii
  of ideal plasma 16
  local 301
  of shallow potential well 47
  of tangential discontinuity 63
  of thin layer 231

b

ballooning instability 316
  growth rate calculation
    in a local approximation 306
    in WKB approximation 309
Bohr-Sommerfeld quantisation condition 239

c

causality principle 74
characteristics (constant phase lines), for Alfvén waves with m≫1 on the coordinate surfaces x^3=const 333
coordinate surfaces 331
coordinate system
  Cartesian
    for box model 12
    for tangential discontinuity near the magnetopause 63
  curvilinear, field line oriented
    dipole-like 138
    for near-Earth's geotail 299

Magnetospheric MHD Oscillations: A Linear Theory, First Edition. Anatoly Leonovich, Vitalii Mazur, and Dmitri Klimushkin.
© 2024 WILEY-VCH GmbH. Published 2024 by WILEY-VCH GmbH.

coordinate system (*contd.*)
for 3D-inhomogeneous magnetosphere 330, 365
cylindrical, for geotail 99
coupled MHD oscillations 315
slow magnetosonic and Alfvén waves 299
ballooning instability 316
linear transformation in the geotail current sheet 320

d

damping
collisional 4
collisionless 5
dispersion equation
for Alfvén waves 2, 7, 8
for FMS waves 8
in a shear flow 91
for magnetosonic waves 2

e

equations
for Alfvén waves with m≫1 331
for ballooning modes 301
of ideal MHD 1
linearized 1
for MHD-oscillations
in a dipole magnetosphere with a cold plasma 148
in a non-ideal plasma 39
in a 1D-inhomogeneous plasma 15, 16

f

fast magnetosonic mode 2
Cherenkov emission 111, 115
decay in the Alfvén resonance region 46
energy flux 67
reflection coefficient from magnetopause in a dipole magnetosphere model 191
reflection from inhomogeneity 13
spatial structure in a dipole magnetosphere 151, 178
transparent regions in a dipole magnetosphere model 182
turning point 13, 17, 153
wave packet 21
field line resonance (Alfvén resonance) 10
Friedrichs (polar) diagrams 2

g

geomagnetic pulsations xxxix
classification xxxix
magic frequencies 185
Pc1, high-latitude 62
Pc3, dayside 162
Pc3, high-latitude 62
Pi2 and SSC oscillations 251
Pi2, substorm 161, 193
group velocity xlii
of Alfvén waves 2, 8
of FMS waves 2
of SMS waves 2
transverse, of Alfvén waves with m≫1 205

h

Hamilton equations xlii
hodograph
for oscillations in the Alfvén resonance region 18, 35
for oscillations in the magnetosonic resonance region 35

i

instability
of global modes, in a cylindrical geotail model 95
growth rate xlii
of MHD-oscillations xlii

k

Kelvin-Helmholtz instability 63, 70, 83

l

linear oscillation theory xlii
linear transformation
of Alfvén and slow magnetosonic waves in the geotail current sheet 320
of large-scale Alfvén wave to kinetic Alfvén wave 232
low-latitude boundary layer (LLBL) 98

m

Mach cone 111, 115
magic frequencies 185
magnetohydrodynamics (MHD) xxxix
magnetosonic resonance 10, 87
  in a dipole magnetosphere 164
  resonance point 31, 32, 87, 89
MASSA experiment 292, 294
method
  contour integral 321
  Fourier transform 267
  Green's function 50
  Laplace transform 235
  multiple-scale 316
  saddle point 228–230, 237, 254, 276, 286, 322
metric tensor 165
MHD modes
  guided 2
  isotropic 2
  phase shift between their field components 3
MHD waves xxxix
  decomposition into potential and vortical components 38
model
  of Alfvén speed distribution 188
  of Alfvén wave generation in MASSA experiment 294
  of geotail 194
    with a current sheet 302
    cylindrical 69, 84, 88, 98, 99
  of ionosphere
    with inclined geomagnetic field 120
    as a thin layer 117
  of magnetopause in form of tangential discontinuity 68
  of magnetosphere xl
    box model 12
    dipole 138, 147
    parabolic 196
    with rotating plasma 164
    3D-inhomogeneous 330
  of plasma filament, cylindrical 56
  of shear flow 71
    in form of transition layer 94
  of transition layer
    in a cold plasma 15
    in a warm plasma 31
  of white noise source for stochastic oscillations 245
model equation, for transverse structure of Alfvén waves with $m \gg 1$ 260

n

near-Earth plasma sheet (NEPS) 189

o

opaque region 13

p

plasma equilibrium condition 30, 304
plasma parameter β 2, xl
Poynting vector 26

r

residue theorem 286
resonance surface
  poloidal 332
  toroidal 332
resonator
  for FMS waves
    in the 'box model' 185
    dipole model, outer magnetosphere 191
    dipole model, plasmasphere 192
    in the near-Earth plasma sheet 193, 196
  for poloidal Alfvén waves near the plasmapause 239

s

Schrödinger equation 44, 57
shear flow 70
  stability 70, 83
    smooth transition layer 94
    tangential discontinuity 88
singular point, bypassing rule 15
slow magnetosonic mode 2
  boundary conditions at the ionosphere 120
stochastic oscillations
  pair correlators 245
  polarisation ellipse 357

stochastic oscillations (*contd.*)
parameters, for Alfvén oscillations with m≫1 248
spectral function 351
white noise source 245

t

tangential discontinuity, matching conditions 66, 90
tensor
of dielectric permeability 7, 25, 38
of plasma conductivity 26, 118
transparent region 13
for Alfvén waves with m≫1 205
for fast magnetosonic mode in a dipole magnetosphere model 182
turning point
ordinary 13, 89, 205, 239
singular 205, 222, 239, 321

w

wave frequency 2
Doppler-shifted 16
local xlii
waveguide 43
for FMS waves 44, 52
for quasilongitudinal Alfvén waves 47
cylindrical 56
for quasi-transverse Alfvén waves 49, 51
cylindrical 58
WKB approximation 17, 21, 142, 152, 178, 179, 201, 208