Cambridge University Press 978-1-107-02600-1 - Transmission Lines: Equivalent Circuits, Electromagnetic Theory, and Photons Richard Collier Index More information

Index

attenuation 6 dB attenuator, 64-5 Coefficient of attenuation, 209-13 bandwidth broadband thin resistive films on a dielectric, 285 low frequency cut-off, 211-16 see also higher order modes Bessel functions, 170-3, 194-7 beyond cut-off attenuator, 202-5 Brillouin, 298 capacitance coaxial cable, 112-13, 116-17 eccentric coaxial cable, 129-31 parallel plate line, 113-14 single wire above a conducting plane, 123-6 theory, 111 three parallel wires, 126-7 two parallel wires, 114-20 two parallel wires above a conducting plane, 127-9 see also link between capacitance and inductance characteristic impedance coaxial cable, 133 eccentric coaxial cable, 130 parallel plate line, 134 single wire above a ground plane, 135 theory, 5-6 three parallel wires, 138 transmission line with losses, 214-16 two parallel wires, 135 circuit theory and transmission line theory, 32-3 circular waveguide, metallic attenuation of the TE11 mode in a metallic circular waveguide, 236 plane wave analysis of a circular metallic waveguide, 262-5 TE modes in a metallic circular waveguide, 171-3 TE₁₁ mode in a metallic circular waveguide, 173-4 TM modes in a metallic circular waveguide, 170 - 3

coaxial cable attenuation, 226-7 capacitance, 112-13, 116-17 characteristic impedance, 133 higher order modes, 174-6 inductance, 132-3 partially filled with a dielectric, 143 plane wave analysis of attenuation, 278-9 complex modes, 310-11 conductance, 219-21 conformal mapping capacitance of a coaxial cable, 116-17 capacitance of parallel wires, 117-20 Smith chart as a conformal mapping, 120-3 coplanar waveguide attenuation, 230-1 characteristic impedance and velocity, 145-7 higher order modes, 191-2 coupled transmission lines band-pass filter using coupled lines, 95-6 band-stop filter using coupled lines, 92-5 basic theory, 76-9 different mode velocities on coupled lines, 81-3 directional coupler, quarter wavelength long, 86-91 directional coupler using different mode velocities, 91-2 hybrid or mixer ring, 102-6 matched termination for coupled lines, 79 - 80pulses on coupled lines, 80-1 transformer using coupled lines, 97-8 Wilkinson power divider, 98-102 dielectric slab guide TE modes in a dielectric slab guide, 179-85 TM modes in a dielectric slab guide, 186-90 dielectric waveguide, rectangular attenuation, 236-7 basic properties, 199-202 directional coupler quarter wavelength long, 86-91 using different mode velocities, 81-3

Cambridge University Press 978-1-107-02600-1 - Transmission Lines: Equivalent Circuits, Electromagnetic Theory, and Photons Richard Collier Index More information

dispersion, 4, 242-4 Distributed circuit element, 3 eccentric coaxial cable capacitance, 129-31 characteristic impedance, 130, 139 inductance, 139 effective dielectric constant coaxial cable partially filled with a dielectric, 143 coplanar waveguide, 146 microstrip, 144-5 parallel plate line partially filled with a dielectric, 142-3 elastance, 113, 127 equivalent circuit small length of loss-less line, 4 small length of lossy line, 209 filters band-pass filter using coupled lines, 95-6 band-stop filter using coupled lines, 92-5 Fresnel reflection coefficient, 266, 269 Gauss' Theorem, 111-12, 150 Goell, 199–202 higher order modes coaxial cable, 174-6 coplanar waveguide, 191-2 microstrip, 190-1 stripline, 192-3 hybrid or mixer ring, 102-6 impedance input impedance of a length of line, 39-40 input impedance of a length of lossy line, 216 - 17reflection from an impedance, 36-7 inductance coaxial cable, 132-3 eccentric coaxial cable, 139 parallel plate line, 131-4 single wire above a ground plane, 135 theory, 131-2 three parallel wires, 137-8 two parallel wires, 134-5 two parallel wires above a ground plane, 138-9 see also link between capacitance and inductance link between capacitance and inductance, 136-7

low frequency limit *see* bandwidth lumped circuit element, 3

matched termination coupled lines, 79–80 single lines, 7

Maxwell's equations, 150-2, 310-11 metamaterials, 311 microstrip attenuation, 229-31 characteristic impedance and velocity, 144 - 5higher order modes, 190-1 mode coupling, 190 momentum and radiation pressure, 300-1 of photons, 298-9 normal incidence see plane waves oblique incidence see plane waves optical fibre attenuation, 236-7 basic properties, 193-9 HE₁₁ mode in optical fibre, 195-9 LP modes in optical fibre, 197-8 parallel plate line attenuation, 228 capacitance, 113-14 characteristic impedance, 134 inductance, 131-4 partially filled with a dielectric, 142-3 plane wave analysis of attenuation, TEM, TM and TE modes, 275-7 parallel tee junction, 58-61 fully compensated tee, 60-1 partially compensated tee, 60 uncompensated tee, 58-60 see also power meter calibration parallel wires, three (forming an equilateral triangle) capacitance matrix of three parallel wires, 126 - 7characteristic impedances of three parallel wires, 138 inductance of three parallel wires, 137-8 parallel wires, two (isolated and above a ground plane) attenuation, 228-30 capacitance, 114-20 capacitance of two parallel wires above a conducting plane, 127-9 characteristic impedance of two parallel wires, 135 characteristic impedances of two parallel wires above a ground plane, 138-9 inductance of two parallel wires, 137-8 inductance of two parallel wires above a ground plane, 138-9 phase constant lossless lines, 35-6 lossy lines, 209-13

Cambridge University Press 978-1-107-02600-1 - Transmission Lines: Equivalent Circuits, Electromagnetic Theory, and Photons Richard Collier Index

Index 317

photonic bandgap, 312 photons detecting photons (in the presence of thermal noise), 256-7 extent, wave packets and pulses, 301-5 momentum and radiation pressure, 300-1 momentum of photons, 298-9 photon absorption and reflection from a capacitor, 305-9 some properties of photons, 255 velocity of photons and electrons, 295-8 plane waves normal incidence on thin resistive films, 283 - 5oblique incidence on a conductor, TM and TE, 272 - 5oblique incidence on a dielectric interface, TM and TE, 265-72 plane wave analysis of a metallic rectangular waveguide, 257-62 plane wave analysis of a circular metallic waveguide, 262-5 see also coaxial cable, parallel plate, rectangular waveguide, thin resistive films and thin resistive films on a dielectric substrate polarisation circular, 290-1 elliptical, 291 linear, 290 polarising grid of wires, 291-2 vertical and horizontal, 155 power in waves, 37 power meter calibration, 62-4 Poynting's vector, 156-8, 300-1 propagation constant, 209-13 pulses broadening, 244-5 distortion due to the skin effect, 245-50 incident on a resistive termination, 15-19 incident on a resistor and capacitor in parallel, 22-4 photon absorption and reflection from a capacitor, 305-9 pulses on coupled lines, 80-1 Q factor of a resonant length of line, 95, 238-41 quarter-wavelength matching, 51-2 radiation pressure, 300-1, see also photons rectangular waveguide, metallic attenuation of the TE10 mode in a metallic rectangular waveguide, 232-5

plane wave analysis of a metallic rectangular waveguide, 257–62

plane wave analysis of TE_{10} mode attenuation, 277–8

TE modes in a metallic rectangular waveguide, 161 - 4TE₁₀ mode in a metallic rectangular waveguide, 165-9 TM modes in a metallic rectangular waveguide, 163 - 4wave impedance using thin resistive films, 282 - 3reflection coefficient, 6-8 reflections from impedances, 36-7 ridged waveguide, 176-7 scattering parameters, 56-7 short circuit stub response, 65-7 sine waves frequency domain, 35 modulation of sinusoidal waves, 73-4 time domain, 67-73 Single stub matching, 42-8 single wire above a conducting plane capacitance, 123-6 characteristic impedance, 135 inductance, 135 skin effect and sheet resistance anomalous skin effect, 309-10 sheet resistance and reactance, 225-6 sheet resistance in a coaxial cable, 226-7 theory, 221-4 slab guide see dielectric slab guide Smith chart, 40-8 single stub matching using the Smith chart, 42 - 8Smith chart as a conformal mapping, 120-3 Snell's Law, 265 Sommerfeld, 301 step waves incident on a capacitor, 19-21 incident on a resistive termination, 11-15 incident on a short circuit, 8-11 incident on inductors, 30-2 multiple reflections from a capacitor, 24-7 two capacitors in parallel, 27-30 stripline and coupled striplines attenuation, 229-30 characteristic impedance and velocity 139-42 higher order modes, 192-3 Telegraphists' equations, 5, 77, 209, 214 thin resistive films normal incidence, 279-81 oblique incidence, 281-2 wave impedance of rectangular waveguide, 282 - 3thin resistive films a dielectric substrate normal incidence, 283-5

oblique incidence, 285-9

Cambridge University Press 978-1-107-02600-1 - Transmission Lines: Equivalent Circuits, Electromagnetic Theory, and Photons Richard Collier Index More information

318	Index	
	transformer using coupled lines, 97–9 transmission coefficient, 52–6 transmission parameters, 57–8 waveguides <i>see</i> circular waveguide, dielectric slab guide, dielectric waveguide, optical fibre and rectangular waveguide	velocity basic theory, 5–6 phase and group velocity, 242–4 velocity of photons and electrons, 295–8 voltage standing wave ratio lossless lines, 37–9 lossy lines, 217–18
	Wilkinson power divider, 98–102	Wheatstone, 213