

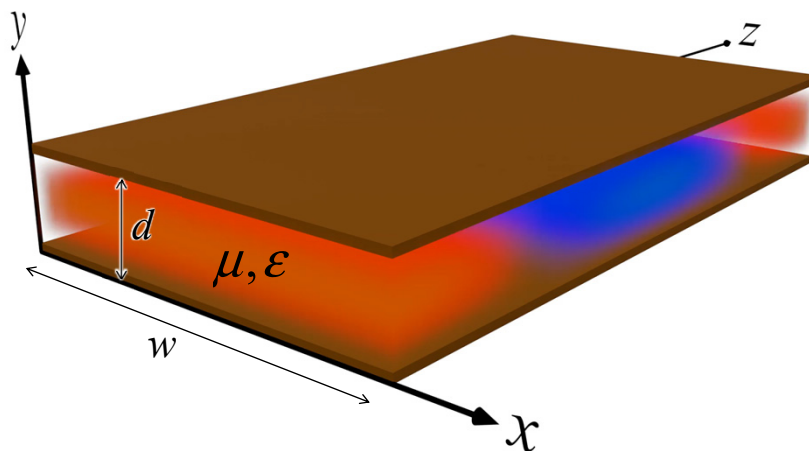


Electromagnetics:
Electromagnetic Field Theory

Introduction to the Parallel Plate Waveguide

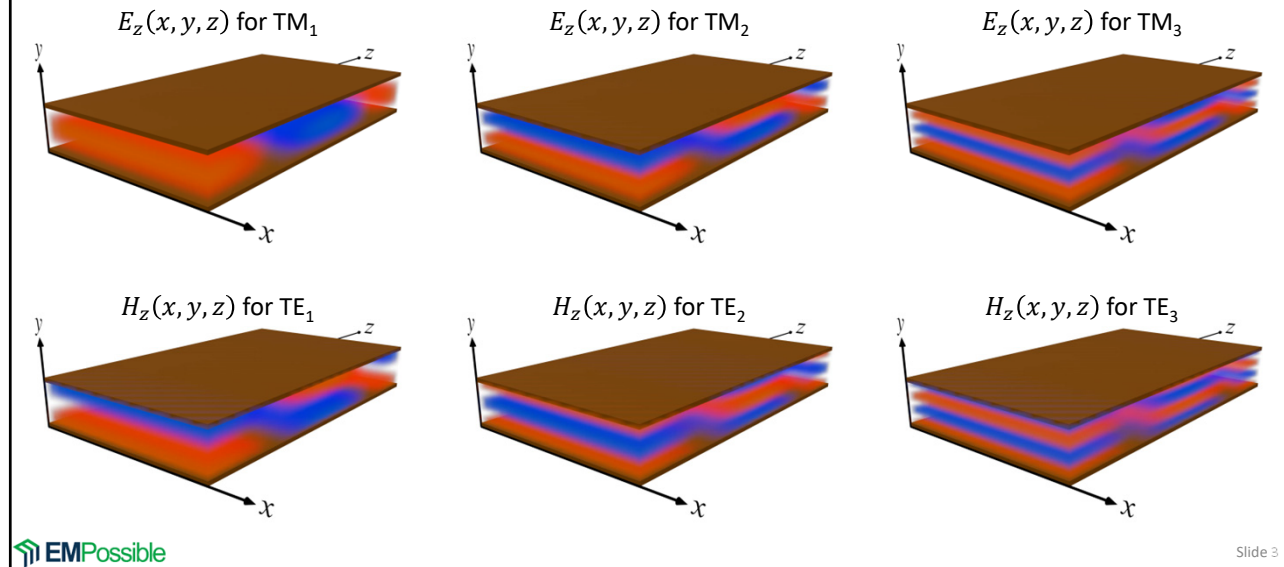
1

Geometry of Parallel Plate Waveguide



2

Modes in a Parallel Plate Waveguide



3

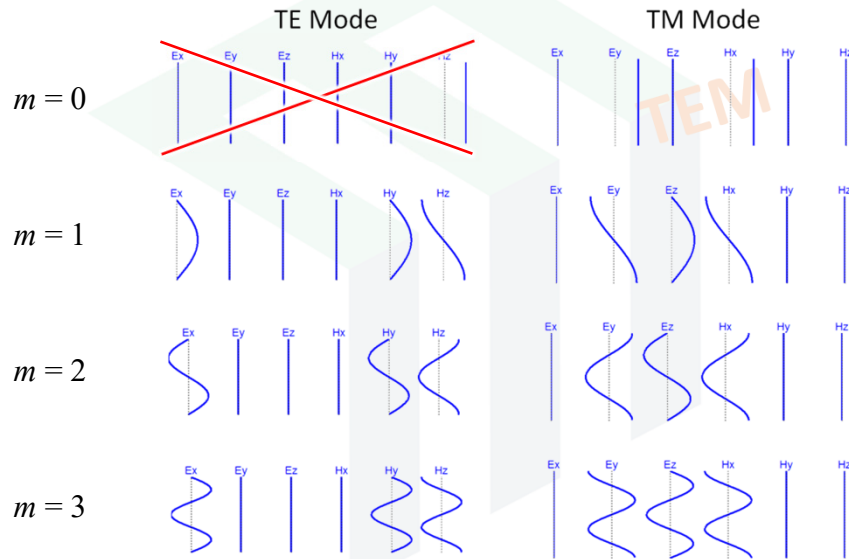
Summary of Parallel Plate Waveguide

Parameter	TEM	TM_m $m = 0, 1, 2, 3, \dots$	TE_m $m = 1, 2, 3, \dots$
k	$\omega\sqrt{\mu\epsilon}$	$\omega\sqrt{\mu\epsilon}$	$\omega\sqrt{\mu\epsilon}$
k_c	0	$m\pi/d$	$m\pi/d$
β	$k = \omega\sqrt{\mu\epsilon}$	$\sqrt{k^2 - k_c^2}$	$\sqrt{k^2 - k_c^2}$
λ_c	∞	$2\pi/k_c = 2d/n$	$2\pi/k_c = 2d/n$
λ_g	$2\pi/k$	$2\pi/\beta_m$	$2\pi/\beta_m$
v_p	$\omega/k = 1/\sqrt{\mu\epsilon}$	ω/β_m	ω/β_m
α_d	$k \tan \delta/2$	$k^2 \tan \delta/2\beta_m$	$k^2 \tan \delta/2\beta_m$
α_c	$R_s/\eta d$	$2kR_s/\beta_m \eta d$	$2k_c^2 R_s/k\beta_m \eta d$
E_x	0	0	$(j\omega\mu/k_c)B_m \sin(m\pi y/d) e^{-j\beta_m z}$
E_y	$(-V_0/d) e^{-j\beta z}$	$(-j\beta_m/k_c)A_m \cos(m\pi y/d) e^{-j\beta_m z}$	0
E_z	0	$A_m \sin(m\pi y/d) e^{-j\beta_m z}$	0
H_x	$(-V_0/\eta d) e^{-j\beta z}$	$(j\omega\epsilon/k_c)A_m \cos(m\pi y/d) e^{-j\beta_m z}$	0
H_y	0	0	$(j\beta_m/k_c)B_m \sin(m\pi y/d) e^{-j\beta_m z}$
H_z	0	0	$B_m \cos(m\pi y/d) e^{-j\beta_m z}$
Z	$\eta d/w$	$\beta_m \eta/k$	$k\eta/\beta_m$

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4

Modes in Parallel Plate Waveguide



Notes

- The parallel plate supports a TEM mode when it has a homogeneous dielectric because it has two conductors.
- Supports TE and TM modes when it has a homogeneous dielectric
- The lowest order mode is TM_0 which is the TEM mode.

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