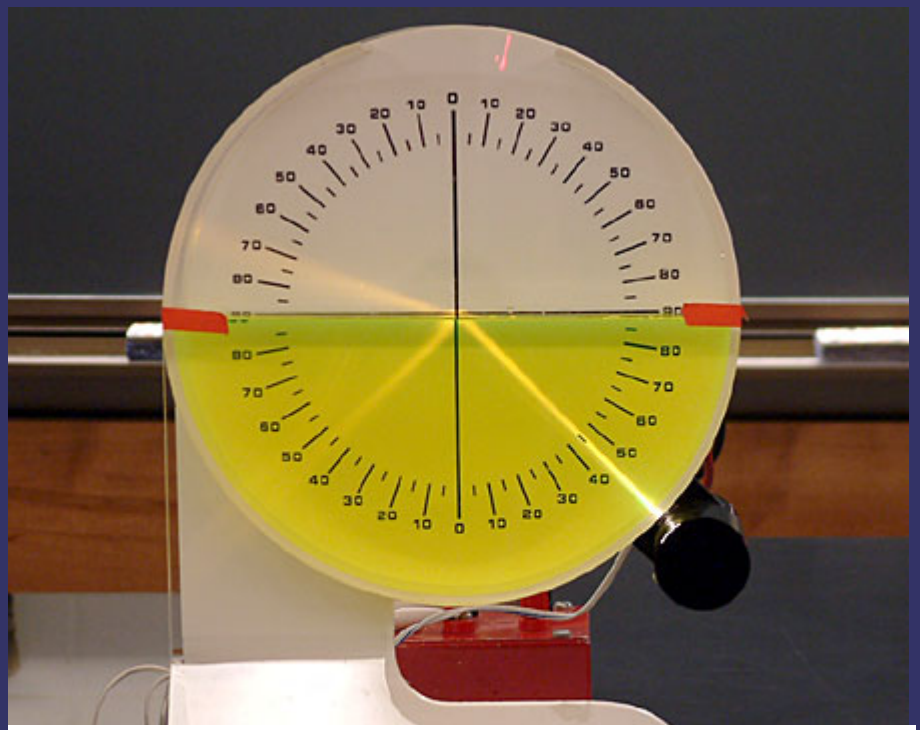
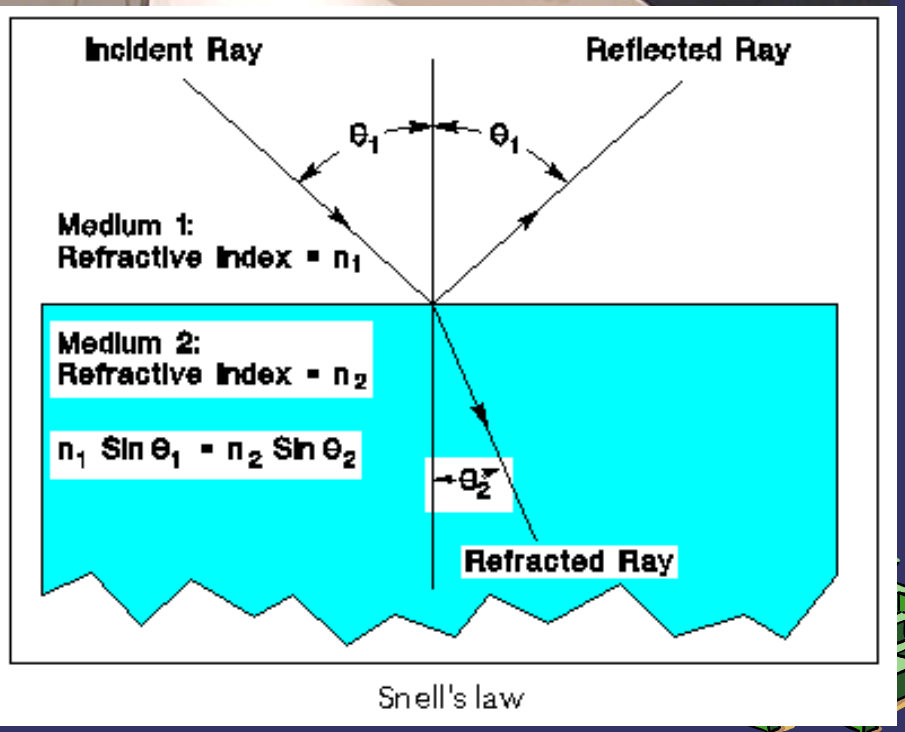
Ο νόμος του Snell

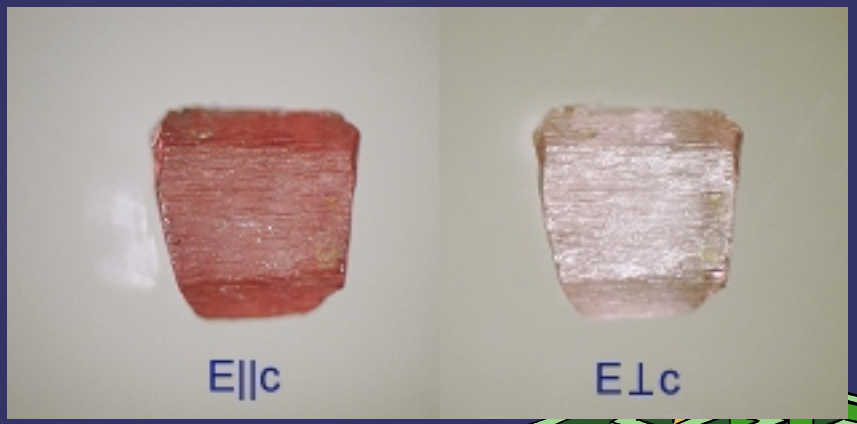




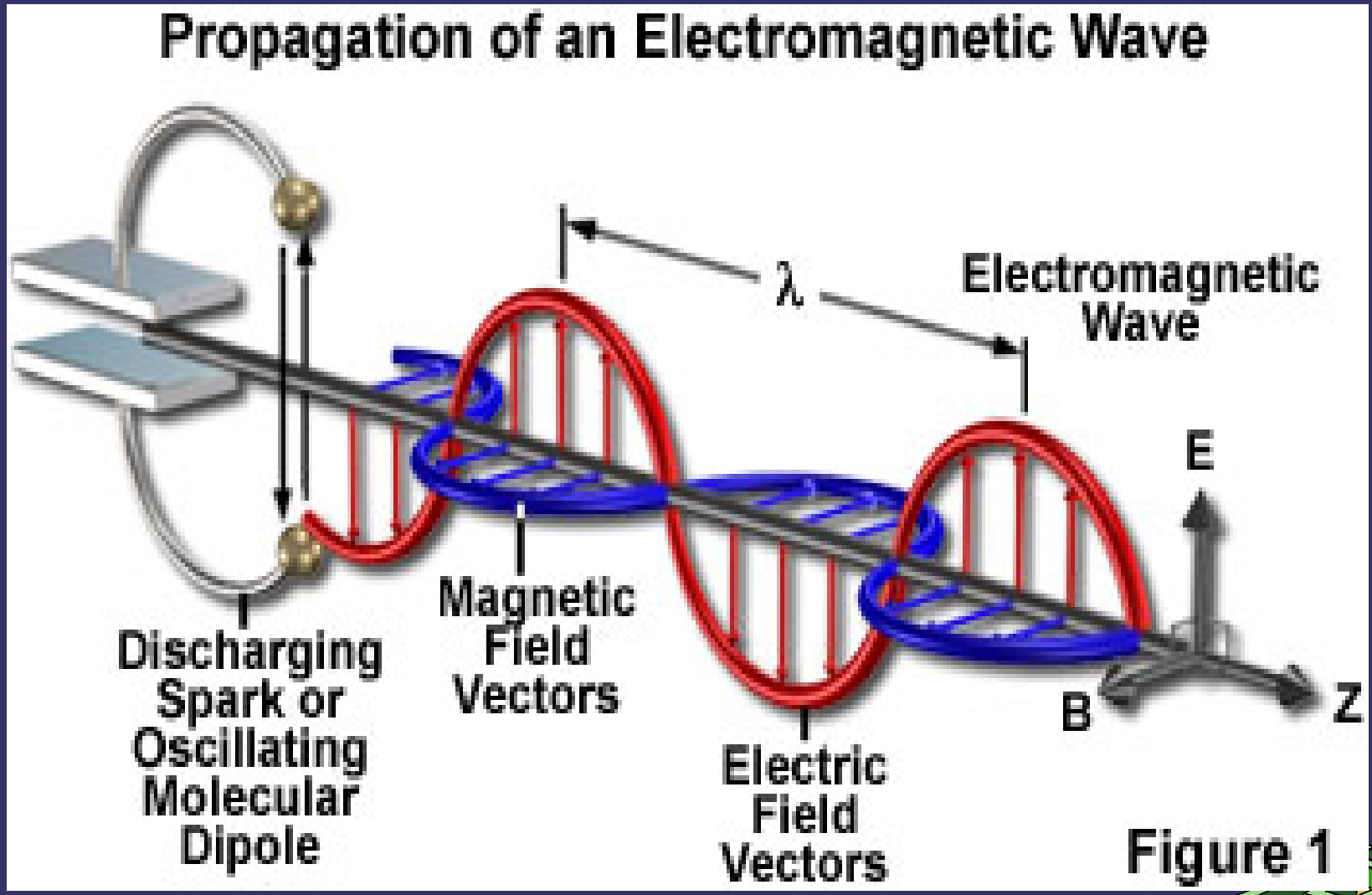
Snell's law


HEALTHY
EATING

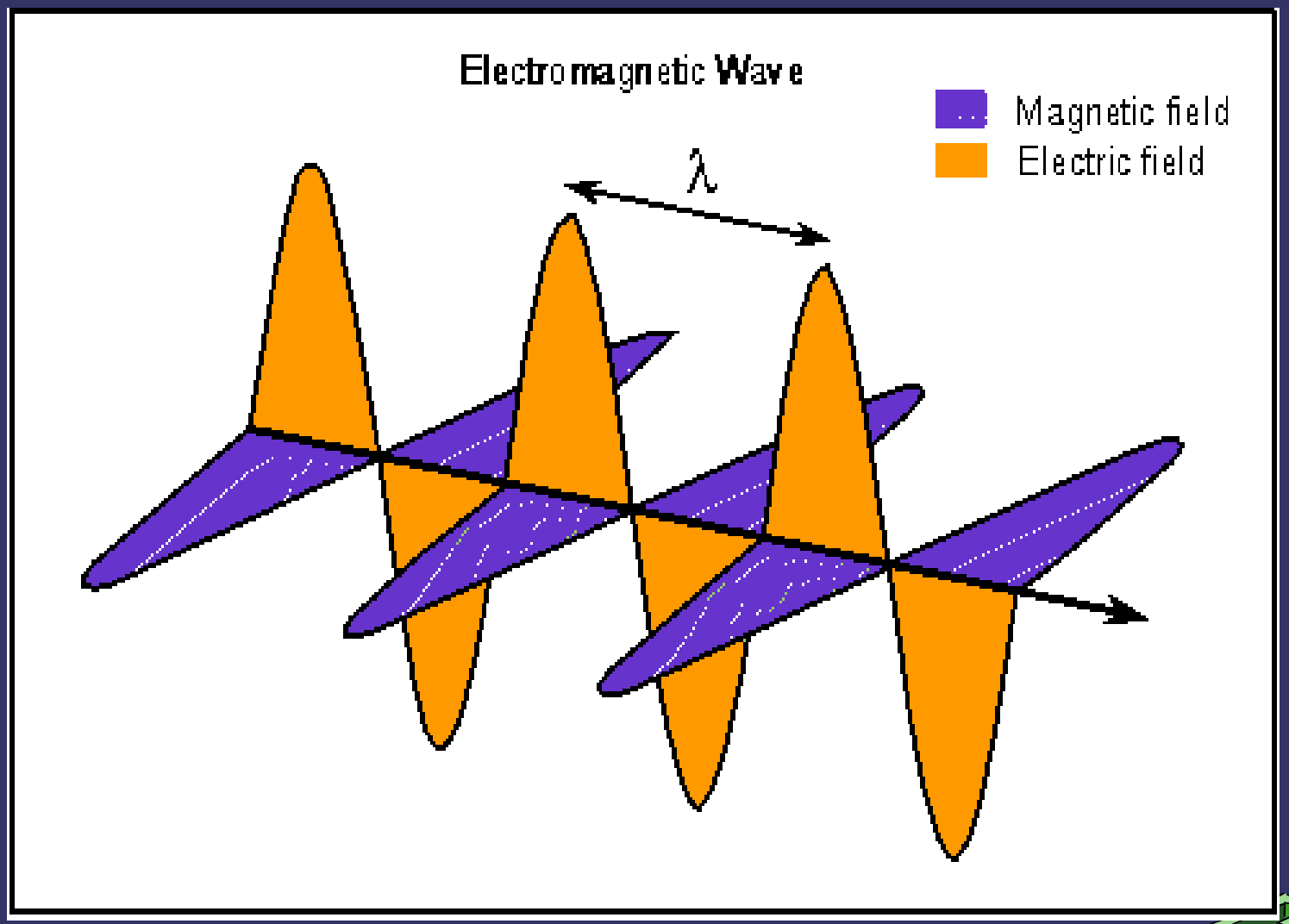
?


E||c
E⊥c

Το ηλεκτρομαγνητικό κύμα



Διάδοση Η/Μ κύματος στο κενό

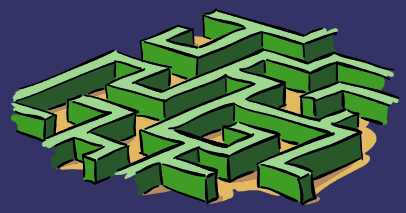


Ένα επίπεδο γραμμικά πολωμένο μονοχρωματικό ηλεκτρομαγνητικό κύμα περιγράφεται από το ηλεκτρικό και το μαγνητικό πεδίο που το αποτελούν, πχ. στο κενό:

$$E_x(z,t) = E_{x0}\cos[2\pi(z/\lambda - \nu t)] = Re\{E_{x0}\exp[i(kz-\omega t)]\}$$
$$H_y(z,t) = H_{y0}\cos[2\pi(z/\lambda - \nu t)] = Re\{H_{y0}\exp[i(kz-\omega t)]\}$$

όπου $k=2\pi/\lambda$, $\omega=2\pi\nu$ και

$\lambda\nu=c$, $\omega=ck$



Electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

Electromagnetic plane wave

INDEX NEXT PREV

Plane Wave in Material Medium

$t = 0.000\,T$ $\omega t = 0°$

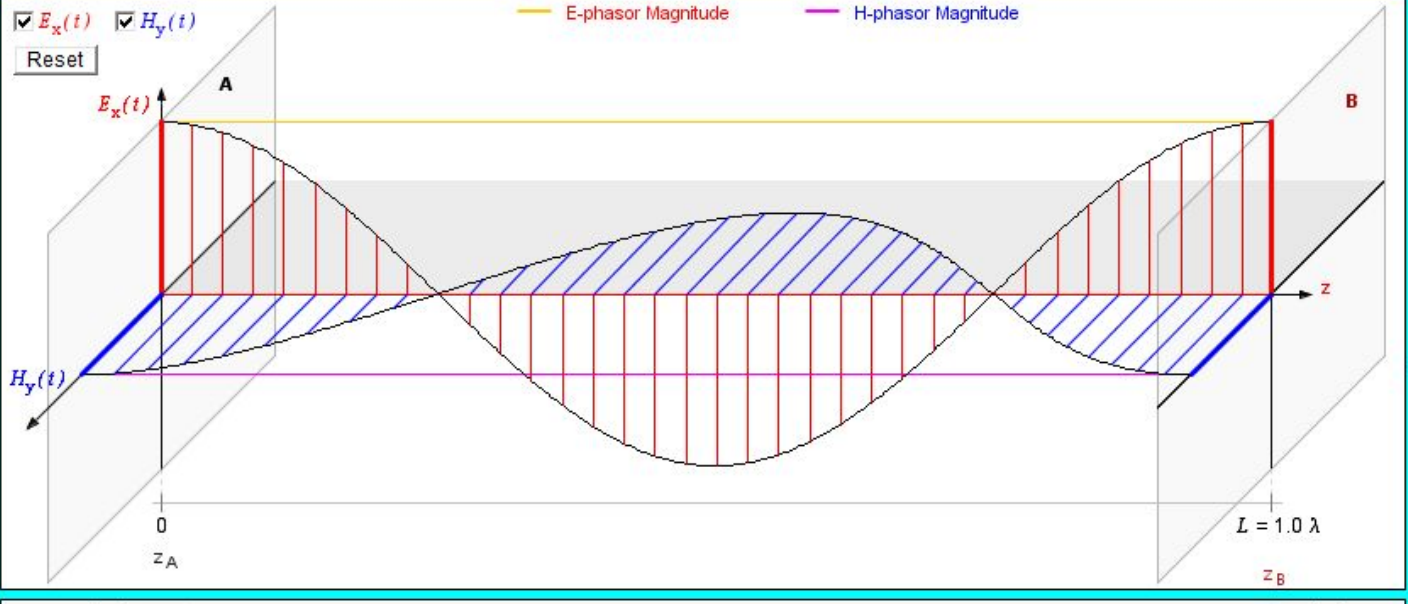
START STOP

Input/Output | Phase Planes | |Phasors|

Animation speed

$E_x(t)$ $H_y(t)$ Reset

E-phasor Magnitude H-phasor Magnitude



A B A B

A) $z_A = 0.0\ \lambda = 0.0$ [m]
$|E_A| = 1.0$ [V/m]
$\angle E_A = 0.0$ [rad]
$|H_A| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_A = 0.0$ [rad]

$f = 1.0$ GHz
$L = 1.0\ \lambda = 0.29979$ [m]

Phasor fields on selected phase planes

B) $z_B = 1.0\ \lambda = 0.29979$ [m]
$|E_B| = 1.0$ [V/m]
$\angle E_B = -6.28319$ [rad]
$|H_B| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_B = -6.28319$ [rad]

Input

Frequency	f =	1.0E9	[Hz]
Conductivity	σ =	0.0	[S/m]
Relative Permittivity	ε_r =	1.0	
Relative Permeability	μ_r =	1.0	
E-field Amplitude (z=0)	E_0 =	1.0	[V/m]
E-field Phase (z=0)	φ =	0.0	[rad]
Length Displayed	L =	1.0	[λ]
[A] & [B] Windows	S =	1.0	[m²]

Update

Output

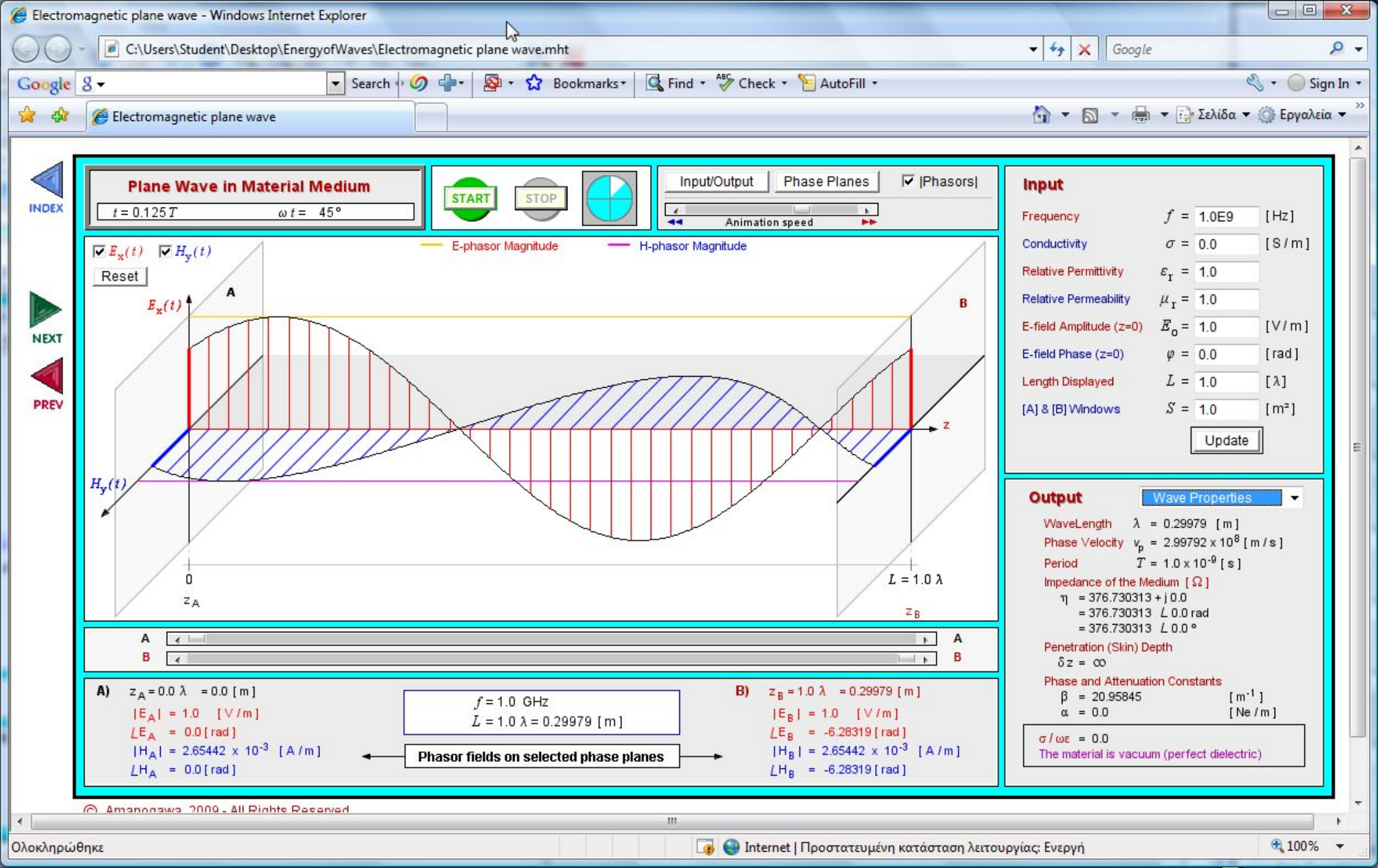
Wave Properties

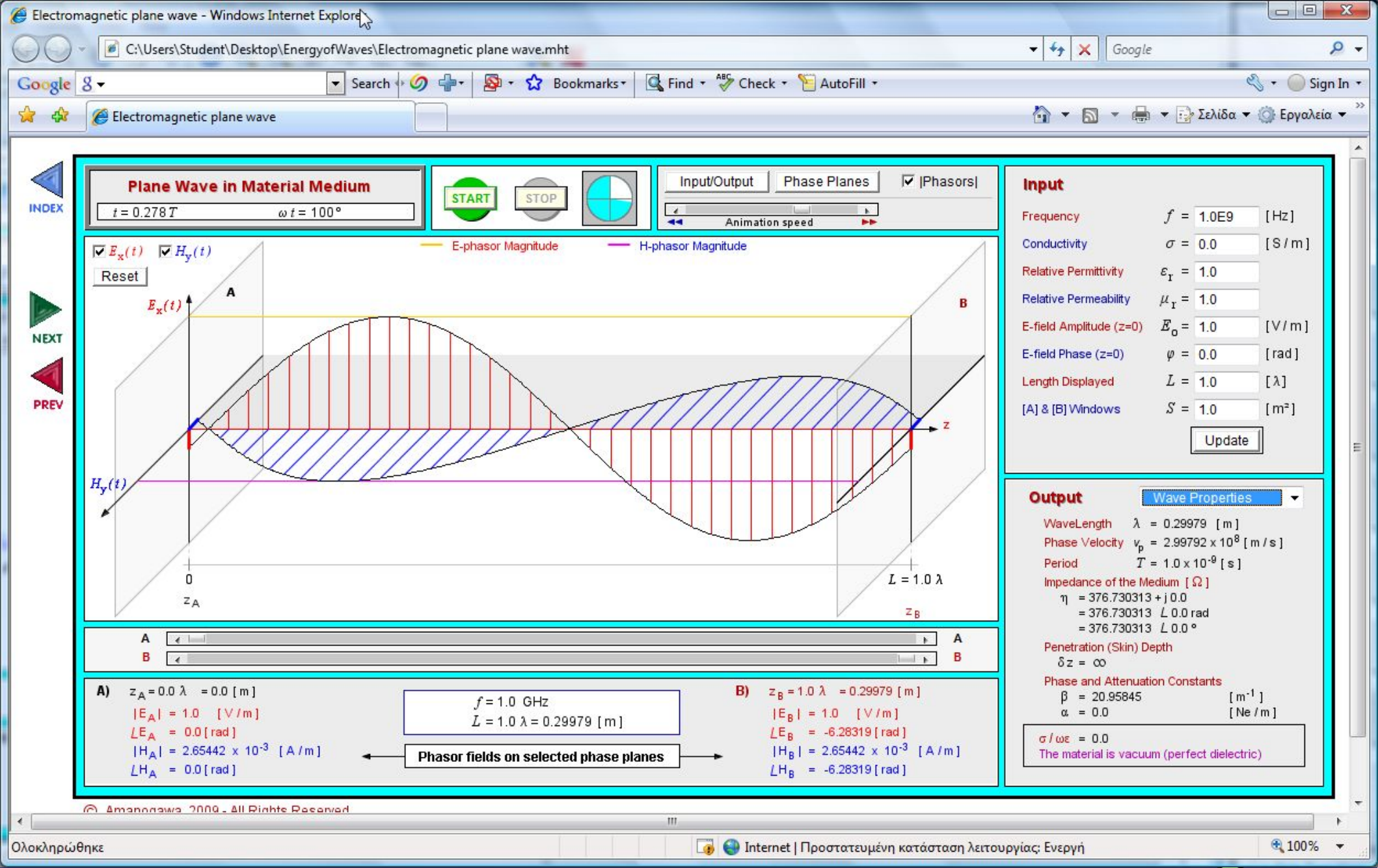
WaveLength $\lambda = 0.29979$ [m]
Phase Velocity $v_p = 2.99792 \times 10^8$ [m/s]
Period $T = 1.0 \times 10^{-9}$ [s]
Impedance of the Medium [Ω]
$\eta = 376.730313 + j\,0.0$
$= 376.730313\ \angle 0.0$ rad
$= 376.730313\ \angle 0.0°$
Penetration (Skin) Depth
$\delta z = \infty$
Phase and Attenuation Constants
$\beta = 20.95845$ [m⁻¹]
$\alpha = 0.0$ [Ne/m]

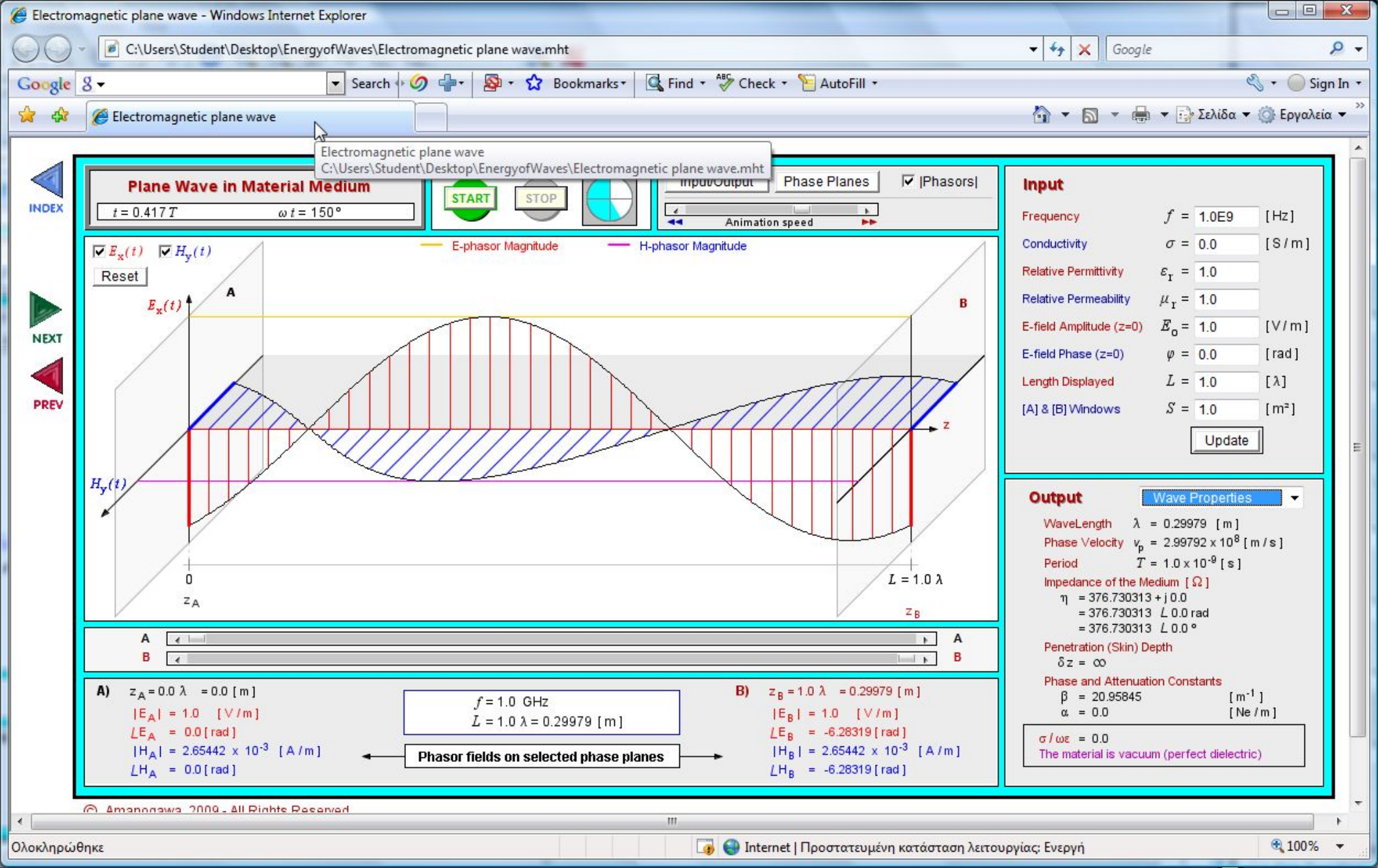
$\sigma/\omega\varepsilon = 0.0$
The material is vacuum (perfect dielectric)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή 100%


Electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht
Electromagnetic plane wave
INDEX
NEXT
PREV
Plane Wave in Material Medium
t = 0.125 T
ω t = 45°
START
STOP
Input/Output
Phase Planes
|Phasors|
Animation speed
E-phasor Magnitude
H-phasor Magnitude
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Frequency f = 1.0E9 [Hz]
Conductivity σ = 0.0 [S/m]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
E-field Amplitude (z=0) E_0 = 1.0 [V/m]
E-field Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
[A] & [B] Windows S = 1.0 [m²]
Update
Output
Wave Properties
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313 + j 0.0
= 376.730313 ∠ 0.0 rad
= 376.730313 ∠ 0.0 °
Penetration (Skin) Depth
δz = ∞
Phase and Attenuation Constants
β = 20.95845 [m^-1]
α = 0.0 [Ne/m]
σ/ωε = 0.0
The material is vacuum (perfect dielectric)
A) z_A = 0.0 λ = 0.0 [m]
|E_A| = 1.0 [V/m]
∠E_A = 0.0 [rad]
|H_A| = 2.65442 x 10^-3 [A/m]
∠H_A = 0.0 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
Phasor fields on selected phase planes
B) z_B = 1.0 λ = 0.29979 [m]
|E_B| = 1.0 [V/m]
∠E_B = -6.28319 [rad]
|H_B| = 2.65442 x 10^-3 [A/m]
∠H_B = -6.28319 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht
Electromagnetic plane wave
INDEX
NEXT
PREV
Plane Wave in Material Medium
t = 0.278 T
ω t = 100°
START
STOP
Input/Output
Phase Planes
|Phasors|
Animation speed
E-phasor Magnitude
H-phasor Magnitude
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Frequency f = 1.0E9 [Hz]
Conductivity σ = 0.0 [S/m]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
E-field Amplitude (z=0) E_0 = 1.0 [V/m]
E-field Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
[A] & [B] Windows S = 1.0 [m²]
Update
Output
Wave Properties
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313 + j 0.0
= 376.730313 ∠ 0.0 rad
= 376.730313 ∠ 0.0 °
Penetration (Skin) Depth
δz = ∞
Phase and Attenuation Constants
β = 20.95845 [m^-1]
α = 0.0 [Ne/m]
σ/ωε = 0.0
The material is vacuum (perfect dielectric)
A) z_A = 0.0 λ = 0.0 [m]
|E_A| = 1.0 [V/m]
∠E_A = 0.0 [rad]
|H_A| = 2.65442 x 10^-3 [A/m]
∠H_A = 0.0 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
Phasor fields on selected phase planes
B) z_B = 1.0 λ = 0.29979 [m]
|E_B| = 1.0 [V/m]
∠E_B = -6.28319 [rad]
|H_B| = 2.65442 x 10^-3 [A/m]
∠H_B = -6.28319 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht
Electromagnetic plane wave
Plane Wave in Material Medium
t = 0.417 T
ω t = 150°
START
STOP
Input/Output
Phase Planes
|Phasors|
Animation speed
INDEX
NEXT
PREV
E-phasor Magnitude
H-phasor Magnitude
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Frequency f = 1.0E9 [Hz]
Conductivity σ = 0.0 [S/m]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
E-field Amplitude (z=0) E_0 = 1.0 [V/m]
E-field Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
[A] & [B] Windows S = 1.0 [m²]
Update
Output
Wave Properties
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313 + j 0.0
= 376.730313 ∠ 0.0 rad
= 376.730313 ∠ 0.0 °
Penetration (Skin) Depth
δz = ∞
Phase and Attenuation Constants
β = 20.95845 [m^-1]
α = 0.0 [Ne/m]
σ/ωε = 0.0
The material is vacuum (perfect dielectric)
A) z_A = 0.0 λ = 0.0 [m]
|E_A| = 1.0 [V/m]
∠E_A = 0.0 [rad]
|H_A| = 2.65442 x 10^-3 [A/m]
∠H_A = 0.0 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
Phasor fields on selected phase planes
B) z_B = 1.0 λ = 0.29979 [m]
|E_B| = 1.0 [V/m]
∠E_B = -6.28319 [rad]
|H_B| = 2.65442 x 10^-3 [A/m]
∠H_B = -6.28319 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

Electromagnetic plane wave

INDEX NEXT PREV

Plane Wave in Material Medium

$t = 0.556\,T$ $\omega t = 200°$

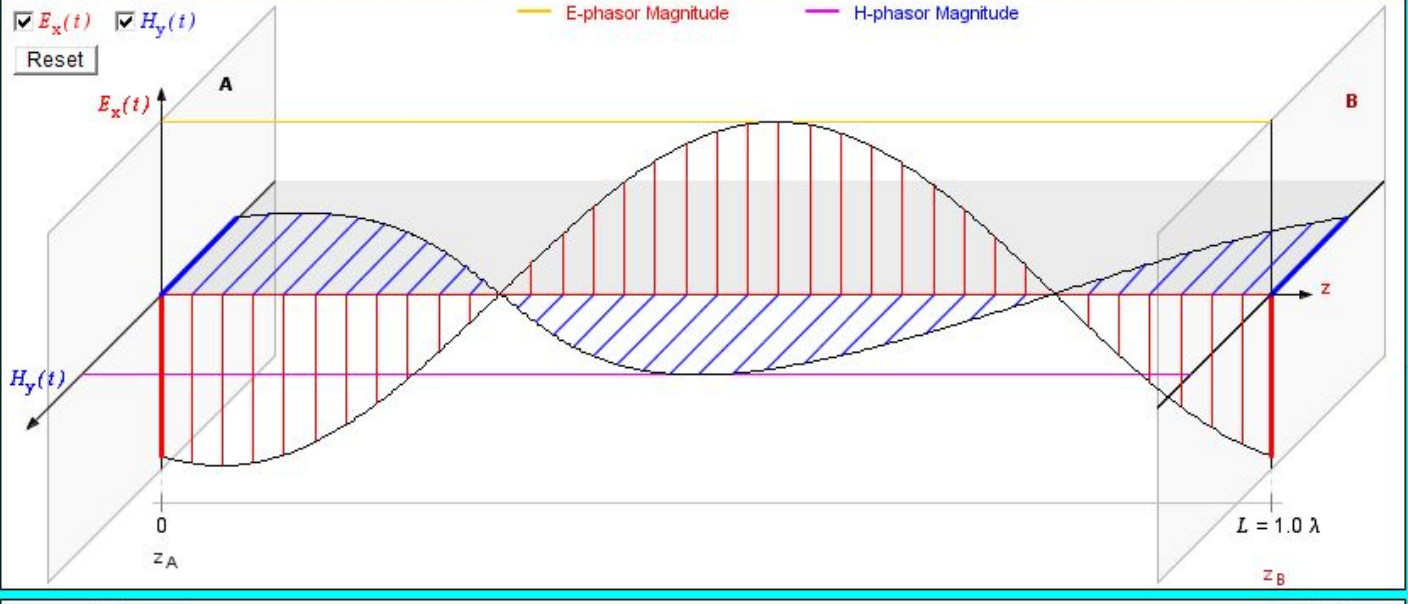
START STOP

Input/Output | Phase Planes | |Phasors|

Animation speed

$E_x(t)$ $H_y(t)$ Reset

E-phasor Magnitude H-phasor Magnitude



A B A B

A) $z_A = 0.0\ \lambda \quad = 0.0$ [m]
$|E_A| = 1.0$ [V/m]
$\angle E_A = 0.0$ [rad]
$|H_A| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_A = 0.0$ [rad]

$f = 1.0$ GHz
$L = 1.0\ \lambda = 0.29979$ [m]

Phasor fields on selected phase planes

B) $z_B = 1.0\ \lambda \quad = 0.29979$ [m]
$|E_B| = 1.0$ [V/m]
$\angle E_B = -6.28319$ [rad]
$|H_B| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_B = -6.28319$ [rad]

Input

Frequency	f =	1.0E9	[Hz]
Conductivity	σ =	0.0	[S/m]
Relative Permittivity	ε_r =	1.0	
Relative Permeability	μ_r =	1.0	
E-field Amplitude (z=0)	E_0 =	1.0	[V/m]
E-field Phase (z=0)	φ =	0.0	[rad]
Length Displayed	L =	1.0	[λ]
[A] & [B] Windows	S =	1.0	[m²]

Update

Output

Wave Properties

WaveLength $\lambda = 0.29979$ [m]
Phase Velocity $v_p = 2.99792 \times 10^8$ [m/s]
Period $T = 1.0 \times 10^{-9}$ [s]
Impedance of the Medium [Ω]
$\eta = 376.730313 + j\,0.0$
$= 376.730313\ \angle 0.0$ rad
$= 376.730313\ \angle 0.0°$
Penetration (Skin) Depth
$\delta z = \infty$
Phase and Attenuation Constants
$\beta = 20.95845$ [m⁻¹]
$\alpha = 0.0$ [Ne/m]

$\sigma/\omega\varepsilon = 0.0$
The material is vacuum (perfect dielectric)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

Electromagnetic plane wave

INDEX NEXT PREV

Plane Wave in Material Medium

$t = 0.750\,T$ $\omega t = 270°$

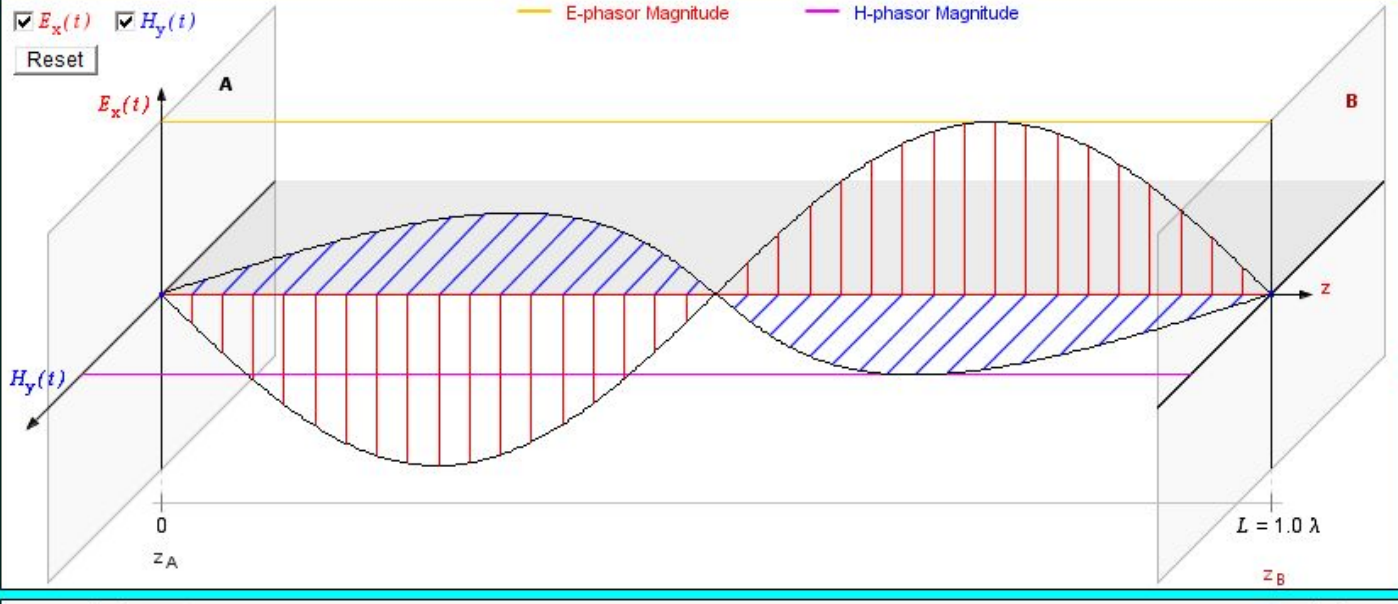
START STOP

Input/Output | Phase Planes | |Phasors|

Animation speed

$E_x(t)$ $H_y(t)$ Reset

E-phasor Magnitude H-phasor Magnitude



A B A B

A) $z_A = 0.0\ \lambda \quad = 0.0$ [m]
$|E_A| = 1.0$ [V/m]
$\angle E_A = 0.0$ [rad]
$|H_A| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_A = 0.0$ [rad]

$f = 1.0$ GHz
$L = 1.0\ \lambda = 0.29979$ [m]

Phasor fields on selected phase planes

B) $z_B = 1.0\ \lambda \quad = 0.29979$ [m]
$|E_B| = 1.0$ [V/m]
$\angle E_B = -6.28319$ [rad]
$|H_B| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_B = -6.28319$ [rad]

Input

Frequency	f =	1.0E9	[Hz]
Conductivity	σ =	0.0	[S/m]
Relative Permittivity	ε_r =	1.0	
Relative Permeability	μ_r =	1.0	
E-field Amplitude (z=0)	E_0 =	1.0	[V/m]
E-field Phase (z=0)	φ =	0.0	[rad]
Length Displayed	L =	1.0	[λ]
[A] & [B] Windows	S =	1.0	[m²]

Update

Output

Wave Properties

WaveLength $\lambda = 0.29979$ [m]
Phase Velocity $v_p = 2.99792 \times 10^8$ [m/s]
Period $T = 1.0 \times 10^{-9}$ [s]
Impedance of the Medium [Ω]
$\eta = 376.730313 + j\,0.0$
$= 376.730313\ \angle 0.0$ rad
$= 376.730313\ \angle 0.0°$
Penetration (Skin) Depth
$\delta z = \infty$
Phase and Attenuation Constants
$\beta = 20.95845$ [m⁻¹]
$\alpha = 0.0$ [Ne/m]

$\sigma/\omega\varepsilon = 0.0$
The material is vacuum (perfect dielectric)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή 100%

Electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

Electromagnetic plane wave

INDEX NEXT PREV

Plane Wave in Material Medium

$t = 0.903\,T$ $\omega t = 325°$

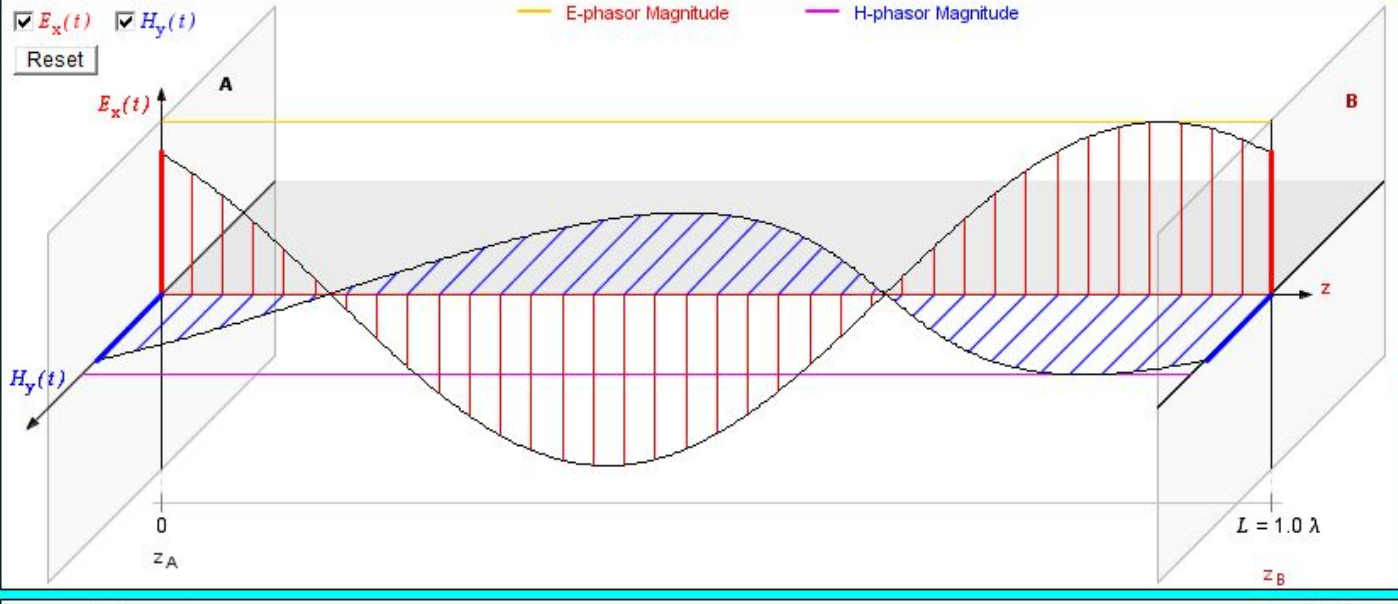
START STOP

Input/Output | Phase Planes | |Phasors|

Animation speed

$E_x(t)$ $H_y(t)$ Reset

E-phasor Magnitude H-phasor Magnitude



A B A B

A) $z_A = 0.0\ \lambda = 0.0$ [m]
$|E_A| = 1.0$ [V/m]
$\angle E_A = 0.0$ [rad]
$|H_A| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_A = 0.0$ [rad]

$f = 1.0$ GHz
$L = 1.0\ \lambda = 0.29979$ [m]

Phasor fields on selected phase planes

B) $z_B = 1.0\ \lambda = 0.29979$ [m]
$|E_B| = 1.0$ [V/m]
$\angle E_B = -6.28319$ [rad]
$|H_B| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_B = -6.28319$ [rad]

Input

Frequency	f =	1.0E9	[Hz]
Conductivity	σ =	0.0	[S/m]
Relative Permittivity	ε_r =	1.0	
Relative Permeability	μ_r =	1.0	
E-field Amplitude (z=0)	E_0 =	1.0	[V/m]
E-field Phase (z=0)	φ =	0.0	[rad]
Length Displayed	L =	1.0	[λ]
[A] & [B] Windows	S =	1.0	[m²]

Update

Output

Wave Properties

WaveLength $\lambda = 0.29979$ [m]
Phase Velocity $v_p = 2.99792 \times 10^8$ [m/s]
Period $T = 1.0 \times 10^{-9}$ [s]
Impedance of the Medium [Ω]
$\eta = 376.730313 + j\,0.0$
$= 376.730313\ \angle 0.0$ rad
$= 376.730313\ \angle 0.0°$
Penetration (Skin) Depth
$\delta z = \infty$
Phase and Attenuation Constants
$\beta = 20.95845$ [m⁻¹]
$\alpha = 0.0$ [Ne/m]

$\sigma/\omega\varepsilon = 0.0$
The material is vacuum (perfect dielectric)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

Electromagnetic plane wave

Electromagnetic plane wave
C:\Users\Student\Desktop\EnergyofWaves\Electromagnetic plane wave.mht

INDEX

NEXT

PREV

Plane Wave in Material Medium

$t = 1.000\,T$ $\omega t = 360°$

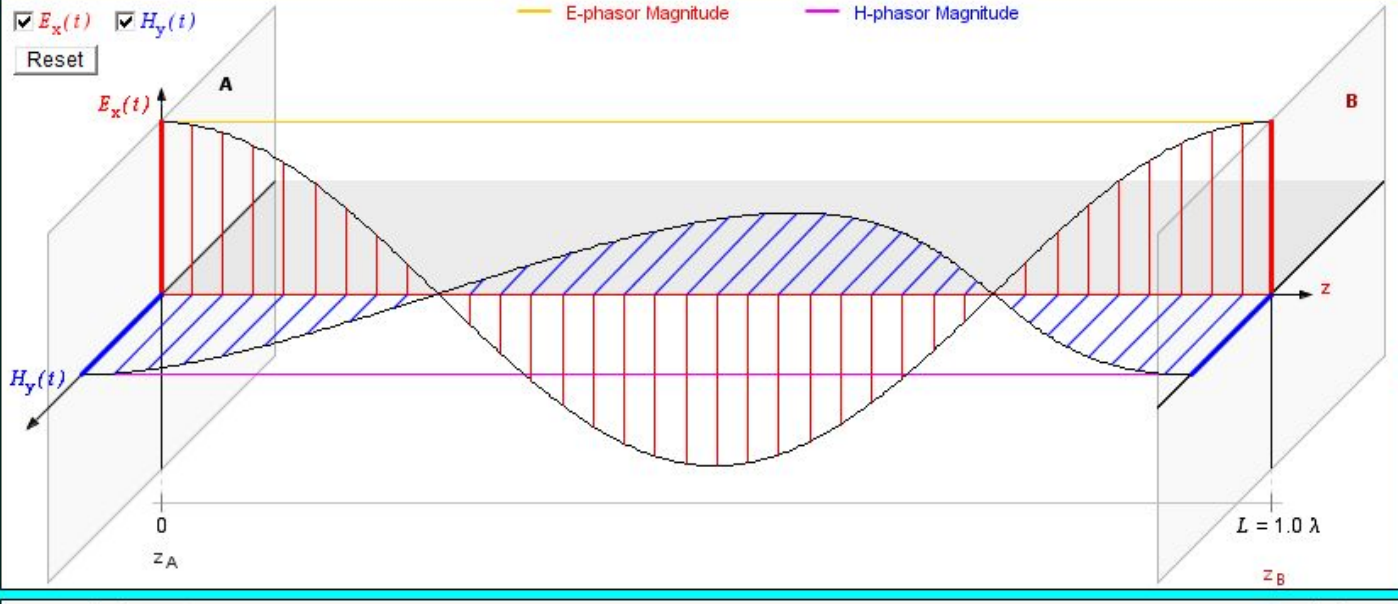
START STOP

Input/Output | Phase Planes | |Phasors|

Animation speed

$E_x(t)$ $H_y(t)$ E-phasor Magnitude H-phasor Magnitude

Reset



A
B
A
B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]
$|E_A| = 1.0$ [V/m]
$\angle E_A = 0.0$ [rad]
$|H_A| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_A = 0.0$ [rad]

$f = 1.0$ GHz
$L = 1.0\ \lambda = 0.29979$ [m]

Phasor fields on selected phase planes

B) $z_B = 1.0\ \lambda$ $= 0.29979$ [m]
$|E_B| = 1.0$ [V/m]
$\angle E_B = -6.28319$ [rad]
$|H_B| = 2.65442 \times 10^{-3}$ [A/m]
$\angle H_B = -6.28319$ [rad]

Input

Frequency	f =	1.0E9	[Hz]
Conductivity	σ =	0.0	[S/m]
Relative Permittivity	ε_r =	1.0	
Relative Permeability	μ_r =	1.0	
E-field Amplitude (z=0)	E_0 =	1.0	[V/m]
E-field Phase (z=0)	φ =	0.0	[rad]
Length Displayed	L =	1.0	[λ]
[A] & [B] Windows	S =	1.0	[m²]

Update

Output

Wave Properties

WaveLength $\lambda = 0.29979$ [m]
Phase Velocity $v_p = 2.99792 \times 10^8$ [m/s]
Period $T = 1.0 \times 10^{-9}$ [s]
Impedance of the Medium [Ω]
$\eta = 376.730313 + j\,0.0$
$= 376.730313\ \angle\ 0.0$ rad
$= 376.730313\ \angle\ 0.0°$
Penetration (Skin) Depth
$\delta z = \infty$
Phase and Attenuation Constants
$\beta = 20.95845$ [m^{-1}]
$\alpha = 0.0$ [Ne/m]

$\sigma / \omega\varepsilon = 0.0$
The material is vacuum (perfect dielectric)

© Amanogawa, 2009 - All Rights Reserved

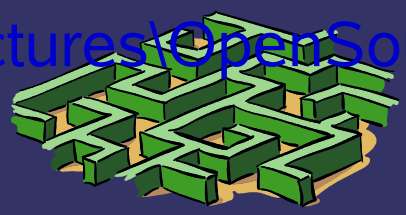
Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Η κατάσταση πόλωσης ενός Η/Μ κύματος περιγράφεται από το οδόγραμμα του ηλεκτρικού του πεδίου που σχηματίζεται όταν το Η/Μ κύμα μας πλησιάζει μετωπικά, π.χ.:

$$E_x(t)=E_{x0}\cos[\phi(t)]$$
$$E_y(t)=E_{y0}\cos[\phi(t)+\varepsilon]$$



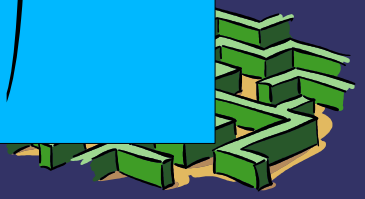
$$\left(\frac{E_y}{E_{y0}}\right)^2+\left(\frac{E_x}{E_{x0}}\right)^2-2\left(\frac{E_y}{E_{y0}}\right)\left(\frac{E_x}{E_{x0}}\right)\cos(\epsilon)=\sin^2(\epsilon)$$

Εάν ε=0° ή 180°:

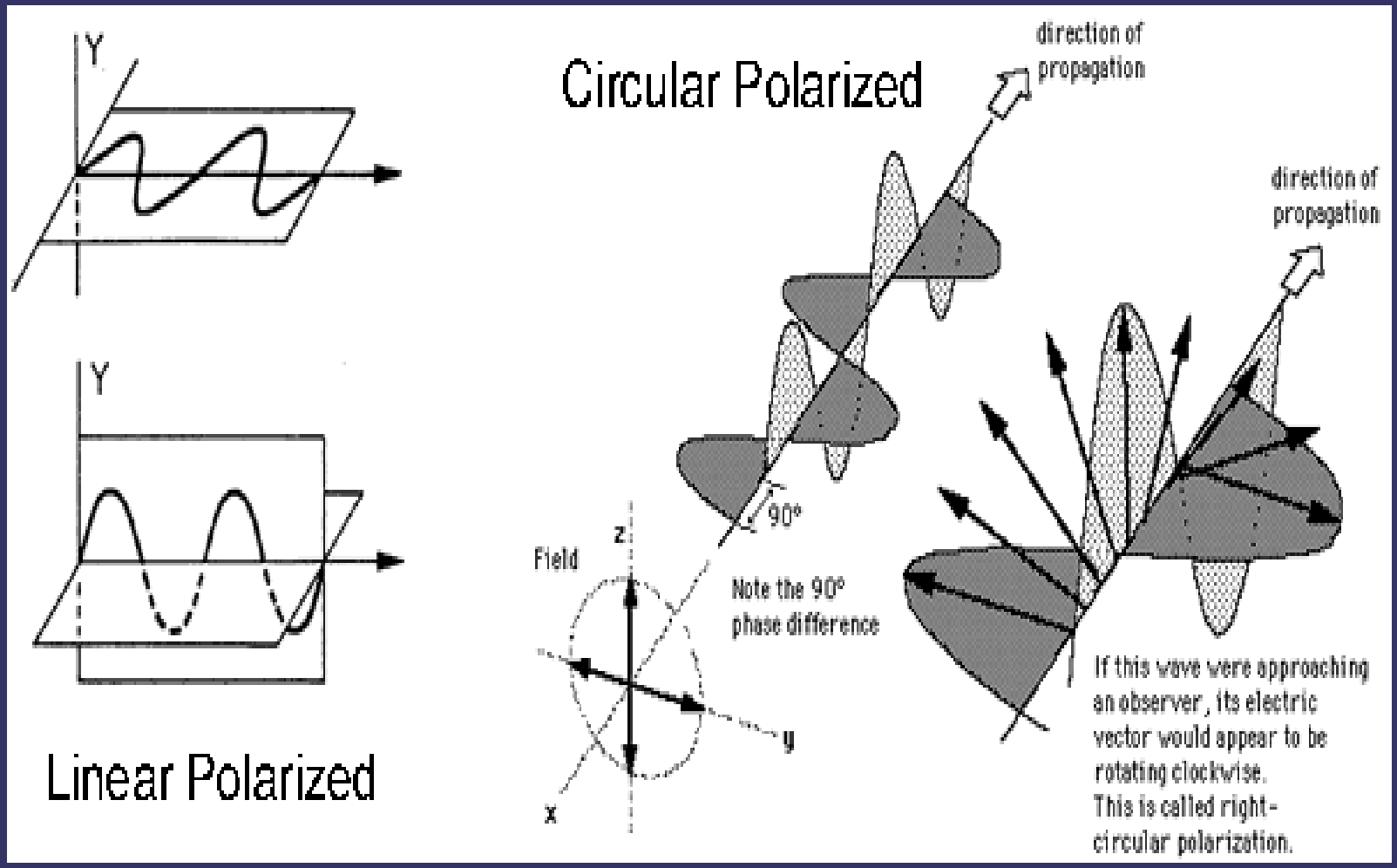
$$\left(\frac{E_y}{E_{y0}}\mp\frac{E_x}{E_{x0}}\right)^2=0$$

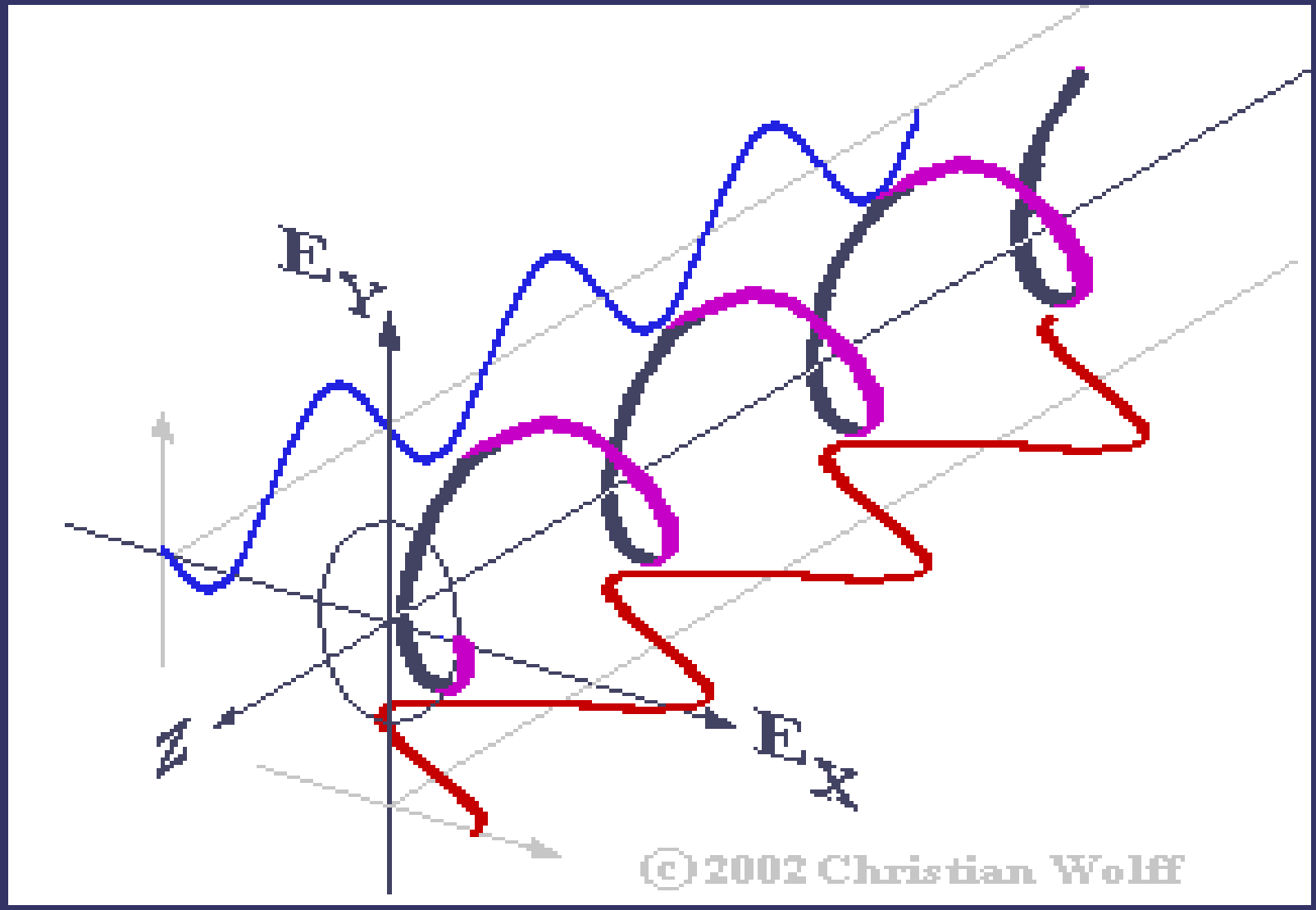
Εάν ε=90° ή -90°:

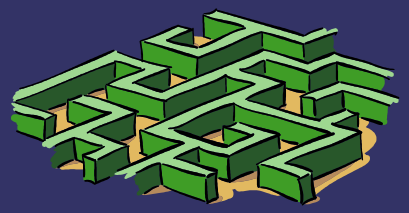
$$\left(\frac{E_y}{E_{y0}}\right)^2+\left(\frac{E_x}{E_{x0}}\right)^2=1$$

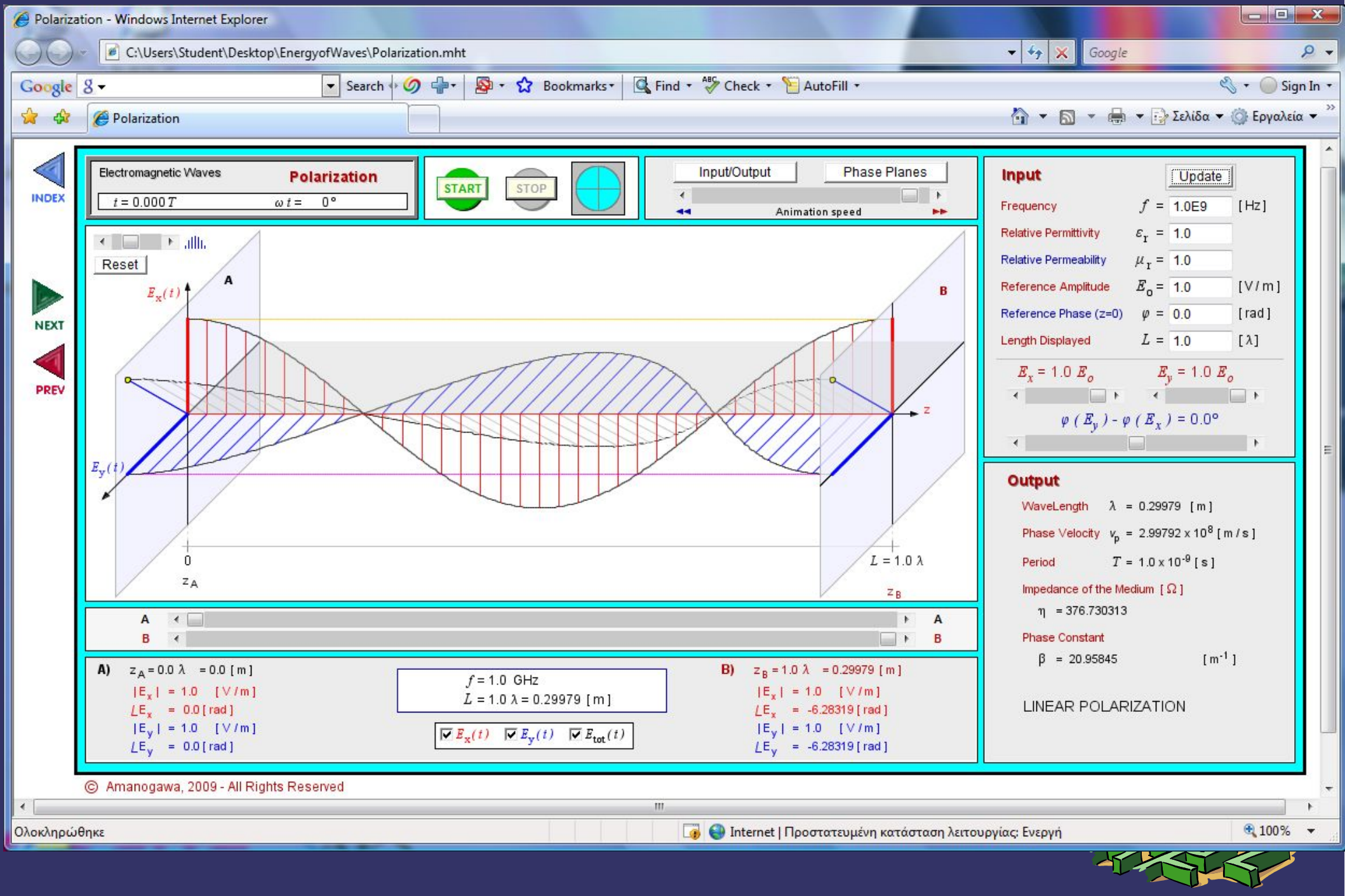


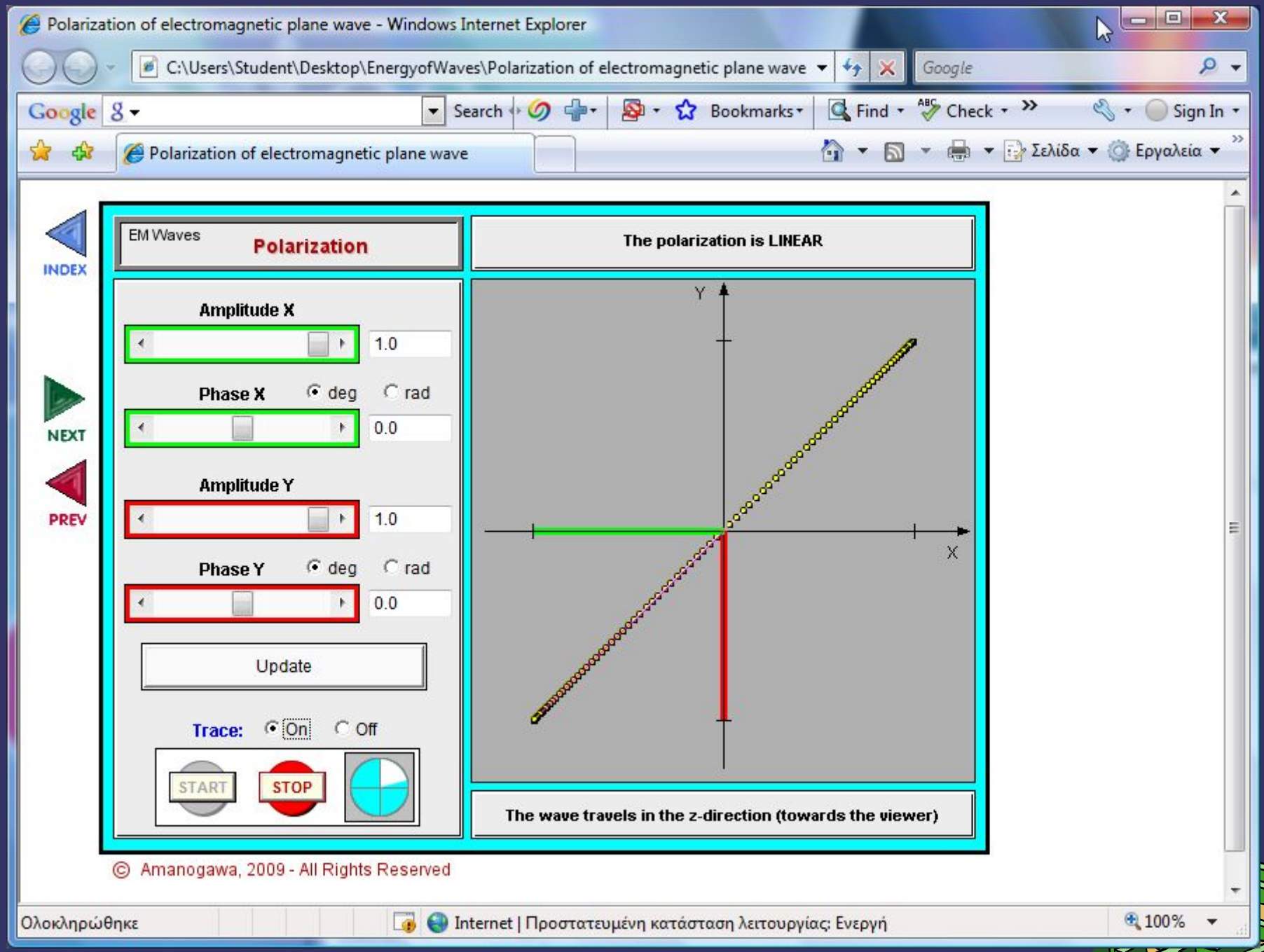
Περίληψη της πόλωσης ($E_{x0}=E_{y0}$)

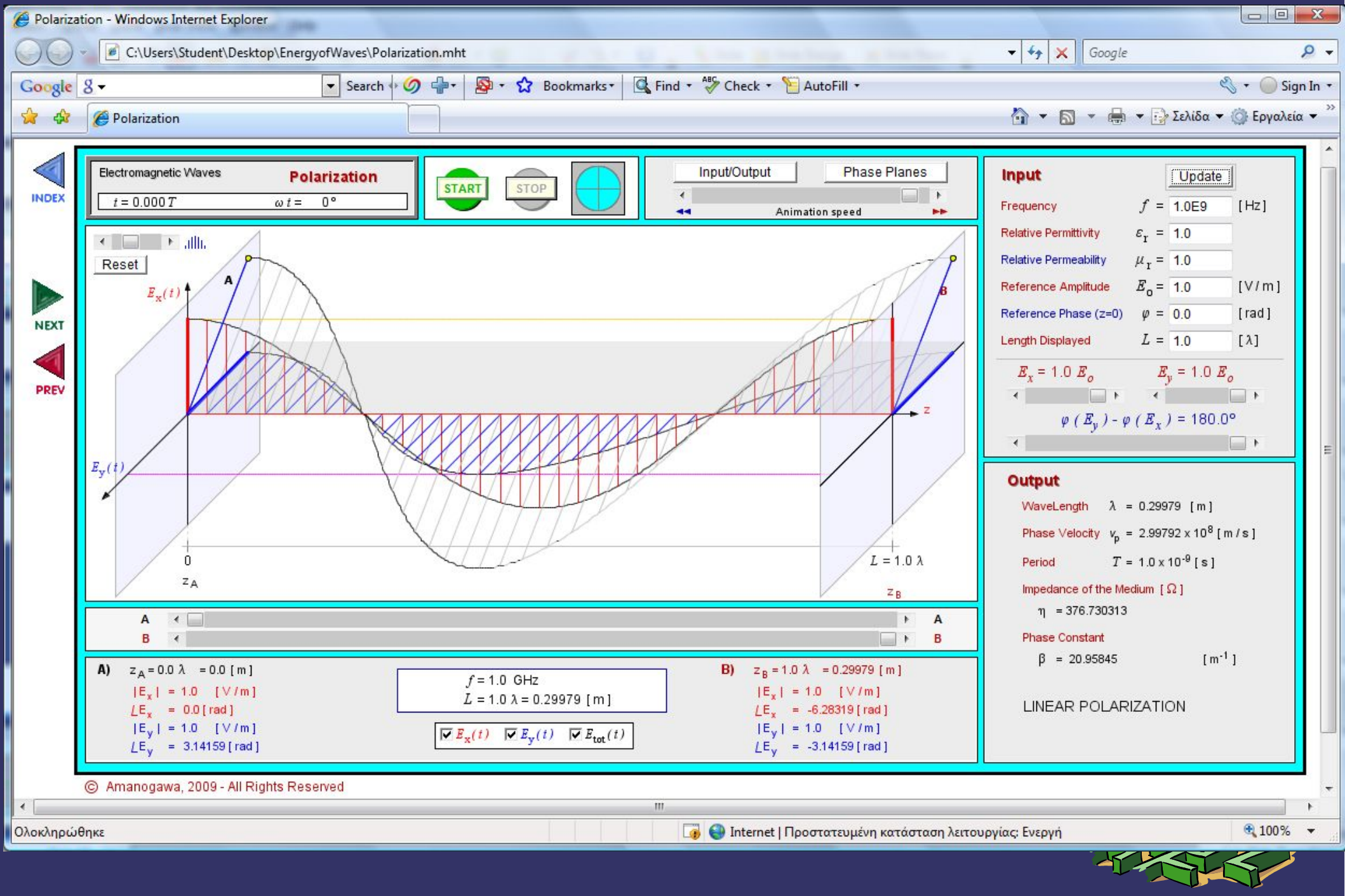


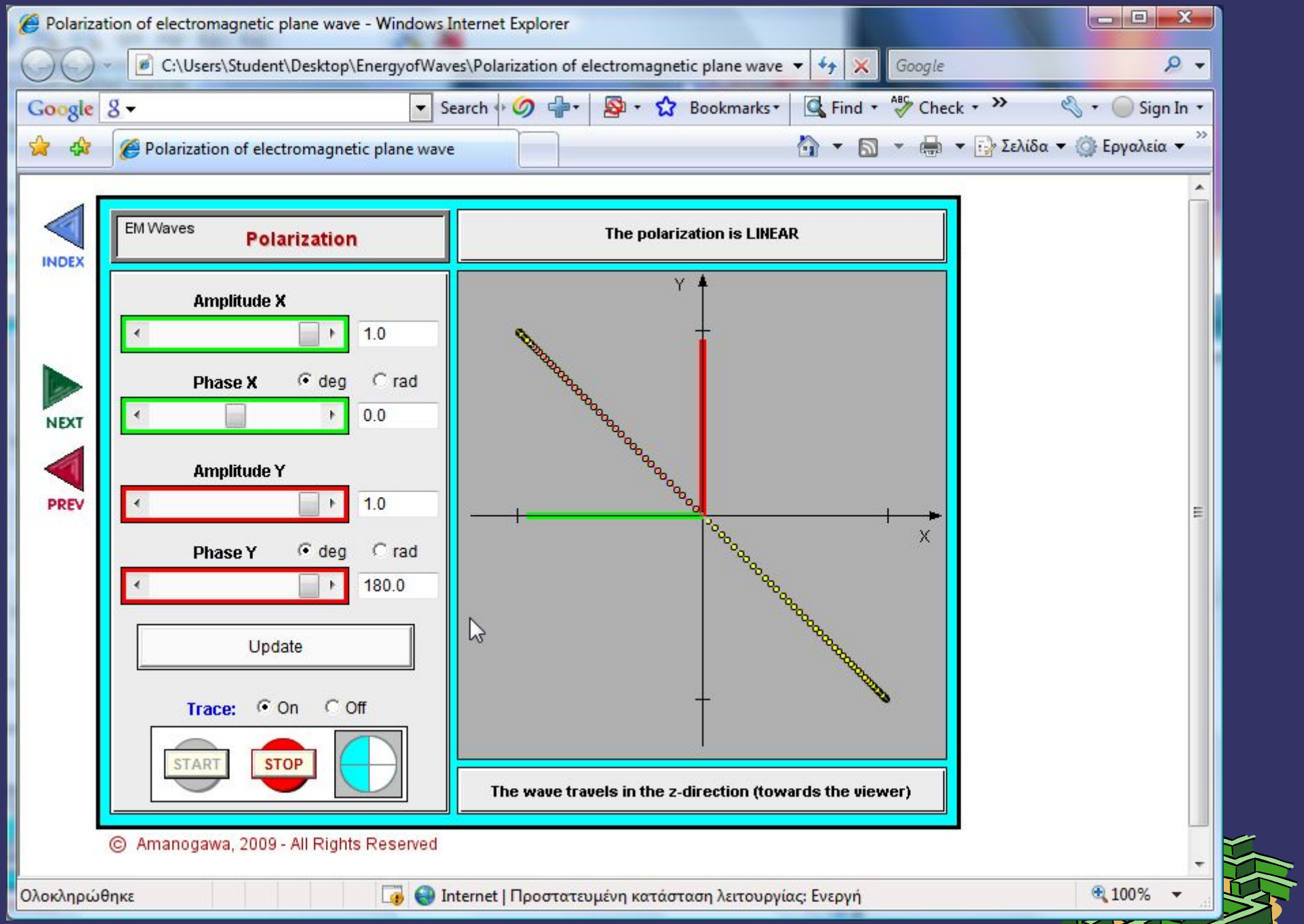

E_y
E_x
z
© 2002 Christian Wolff

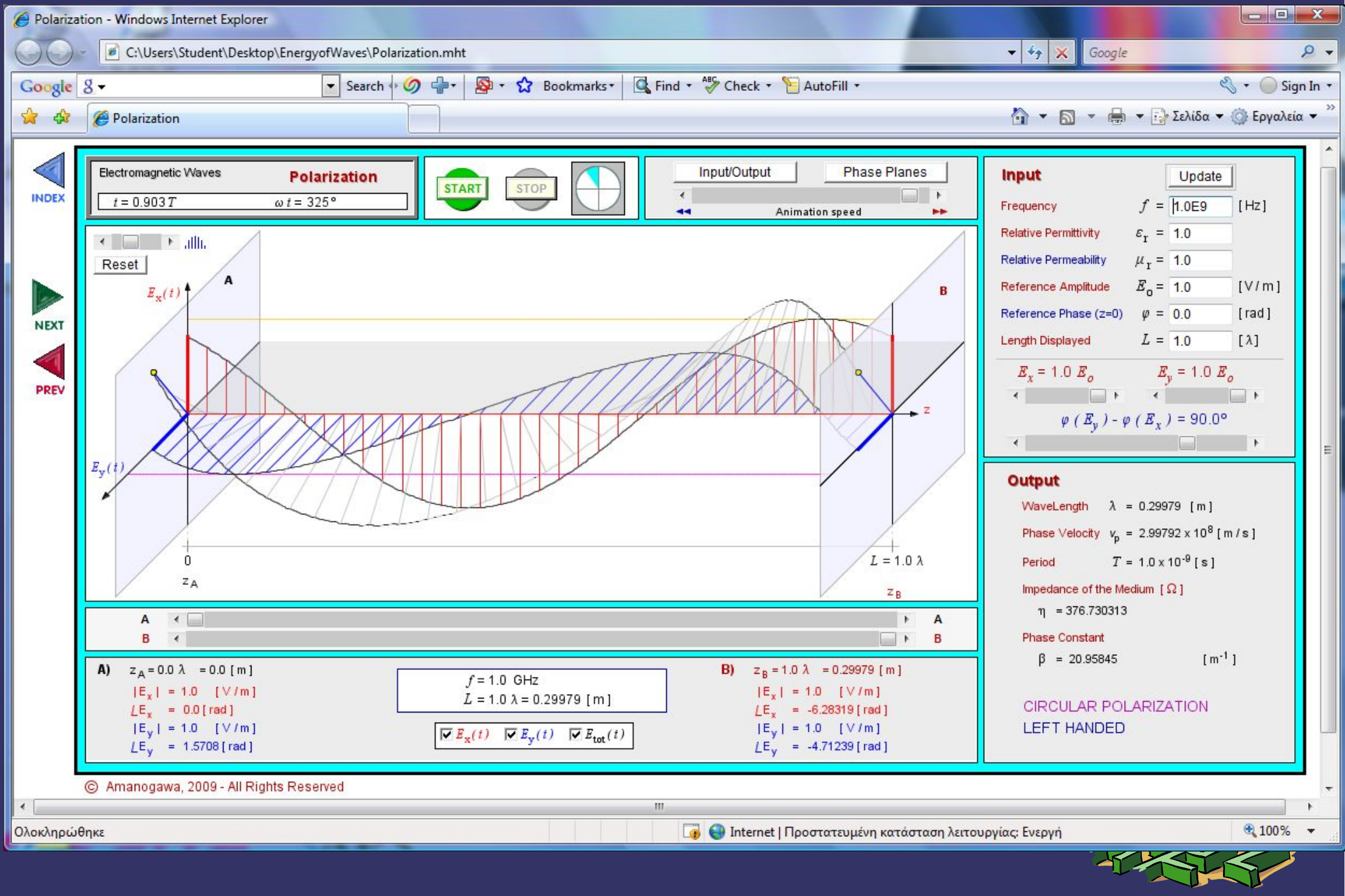


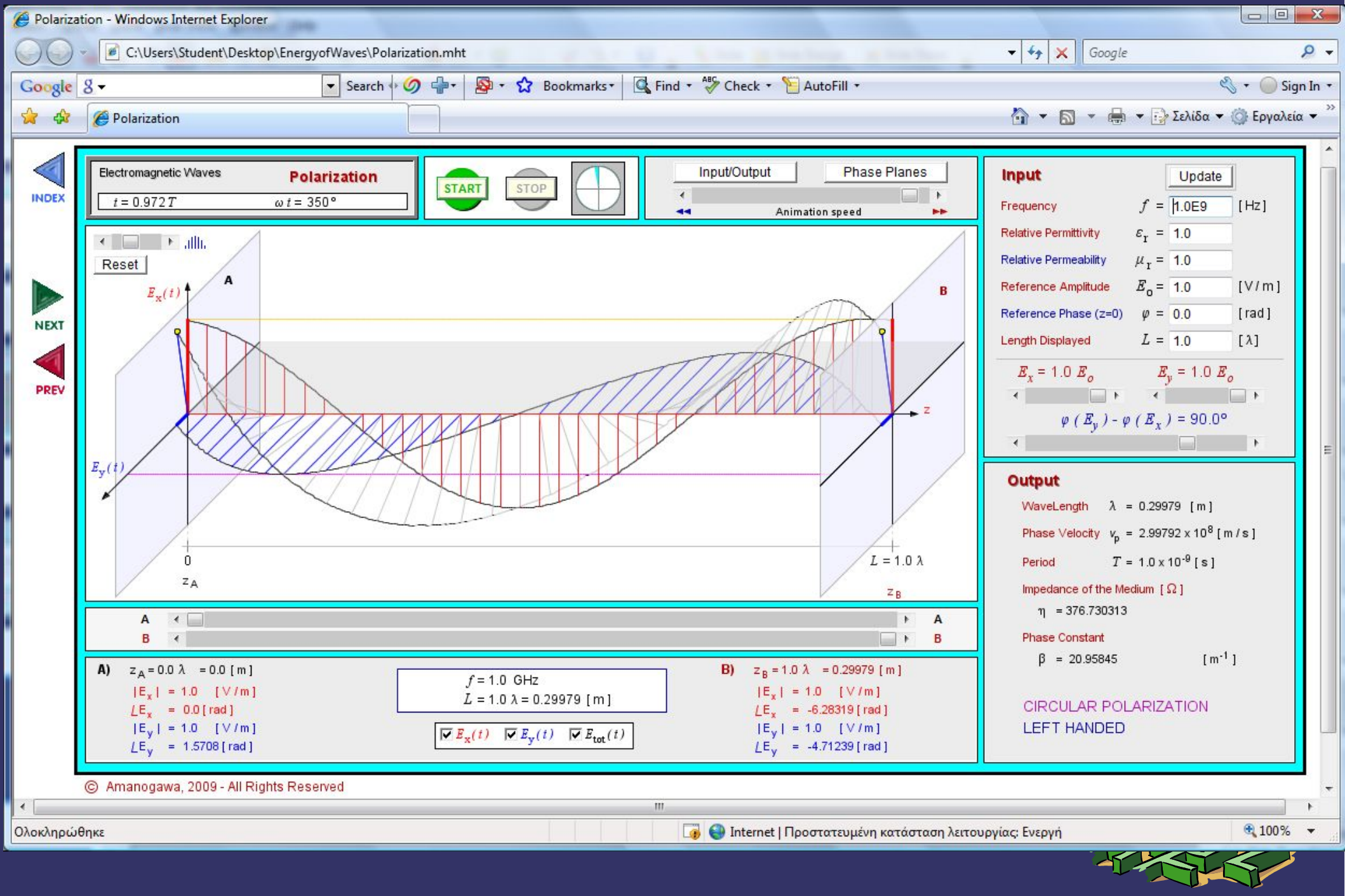

Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.000 T
ω t = 0°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
$E_x = 1.0\ E_o$
$E_y = 1.0\ E_o$
$\varphi(E_y) - \varphi(E_x) = 0.0°$
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^{-9} [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^{-1}]
LINEAR POLARIZATION
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 1.0 [V/m]
$\angle E_y$ = 0.0 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 1.0 λ = 0.29979 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -6.28319 [rad]
$|E_y|$ = 1.0 [V/m]
$\angle E_y$ = -6.28319 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

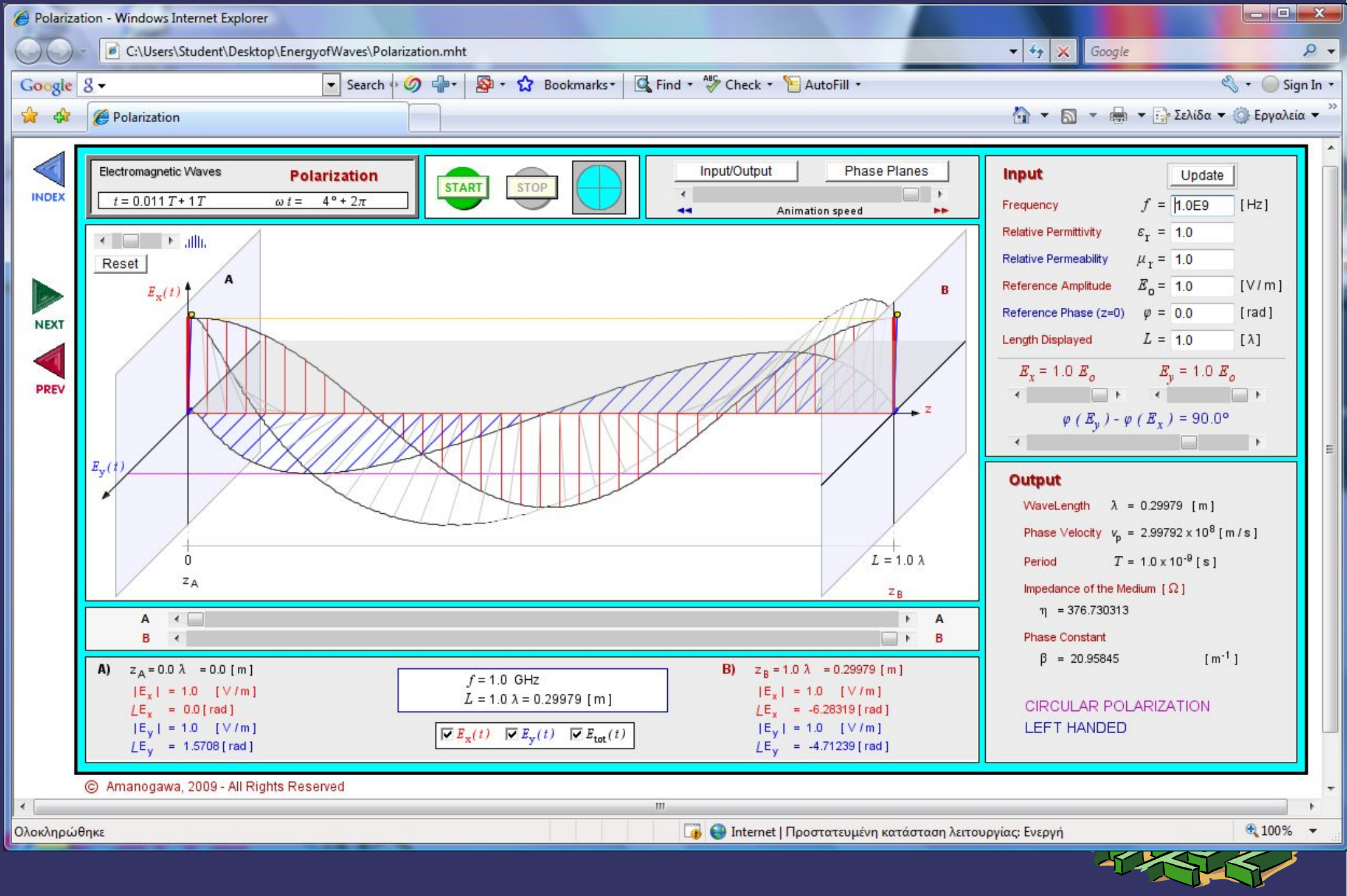

Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is LINEAR
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
1.0
Phase Y
deg
rad
0.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

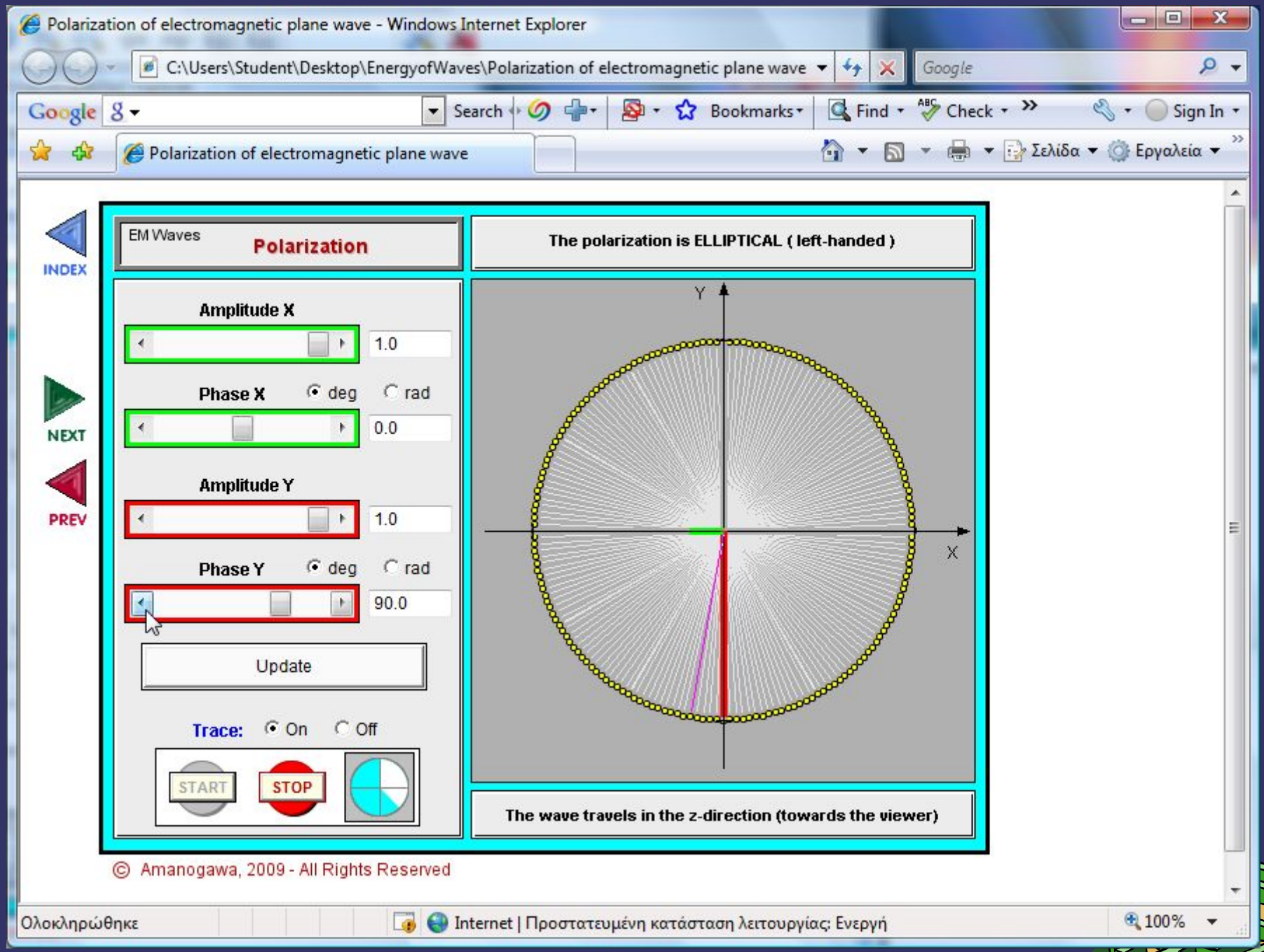

Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.000 T
ω t = 0°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = 180.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
LINEAR POLARIZATION
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = 3.14159 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -3.14159 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

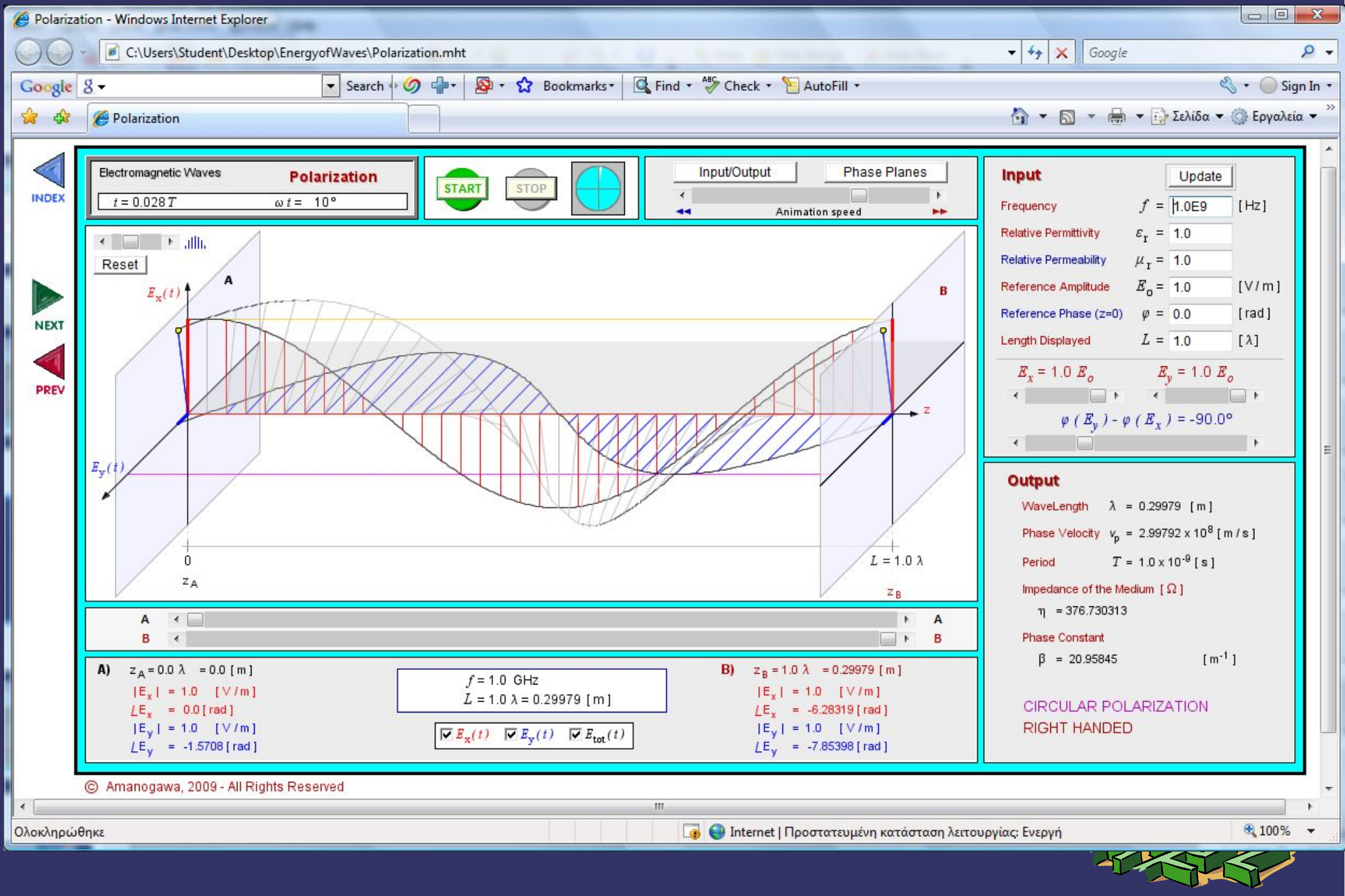

Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is LINEAR
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
1.0
Phase Y
deg
rad
180.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

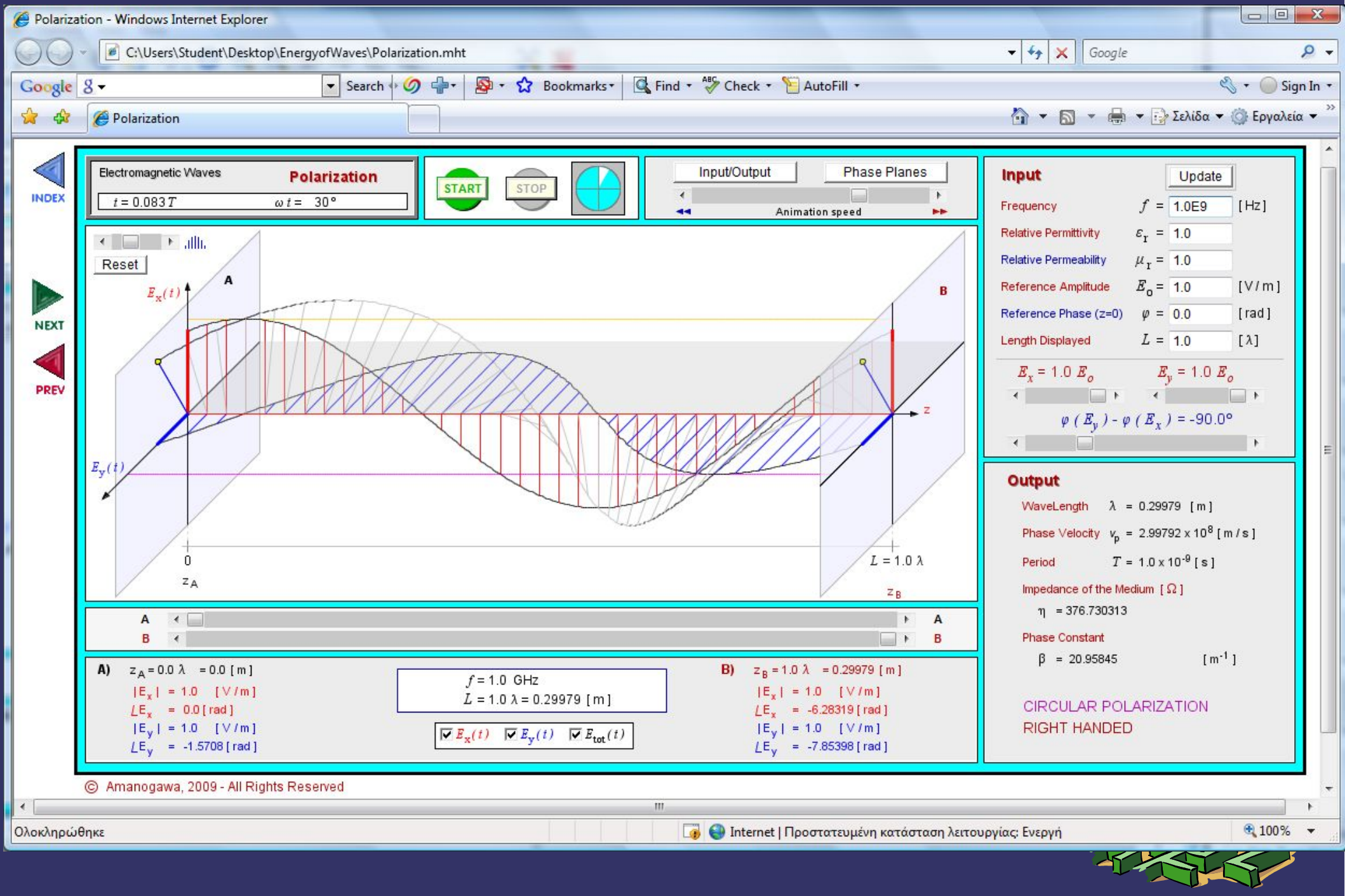

Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.903 T
ω t = 325°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
E_x(t)
E_y(t)
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = 90.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
CIRCULAR POLARIZATION
LEFT HANDED
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = 1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -4.71239 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

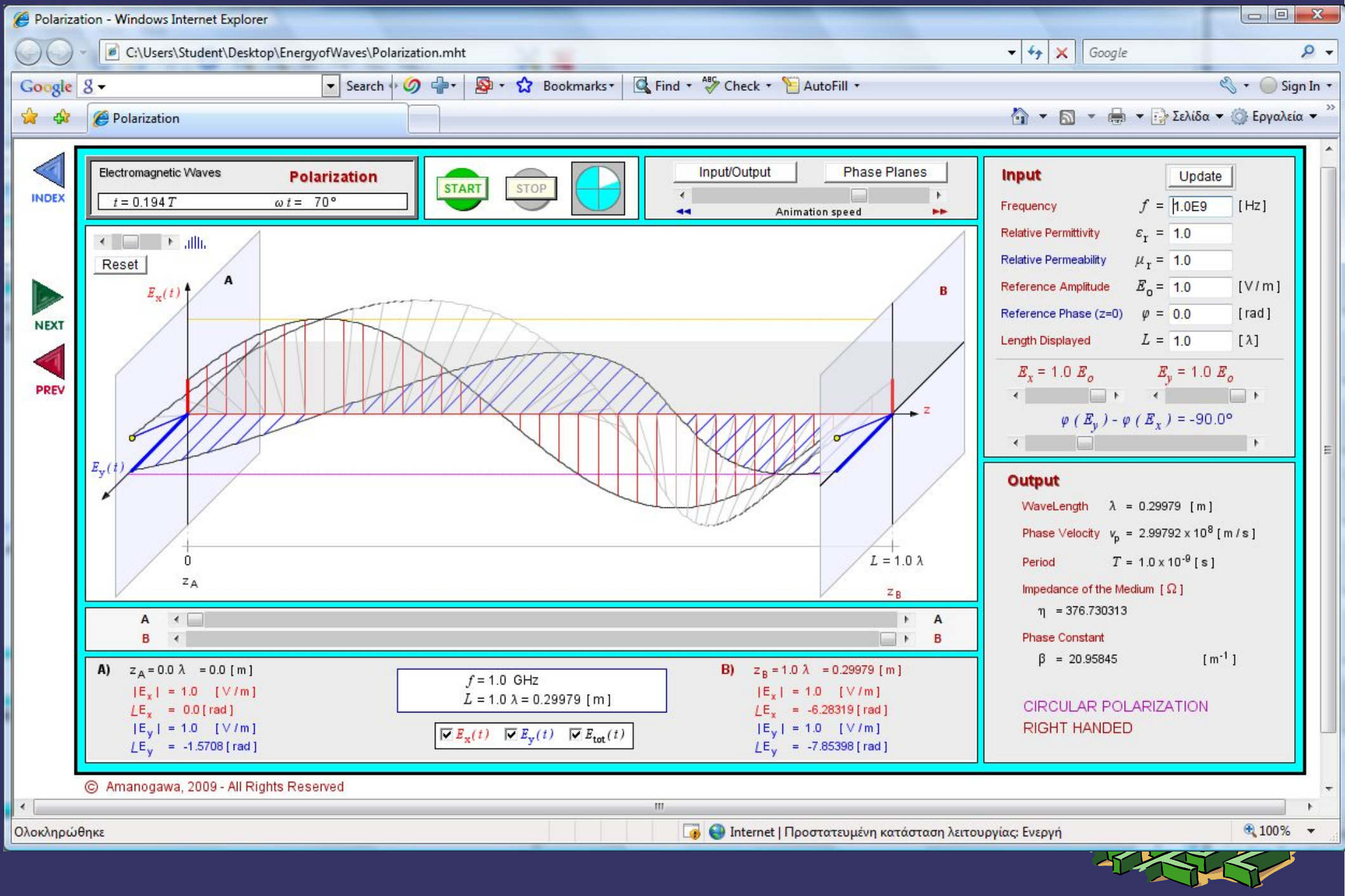

Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.972 T
ω t = 350°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = 90.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
CIRCULAR POLARIZATION
LEFT HANDED
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = 1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -4.71239 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

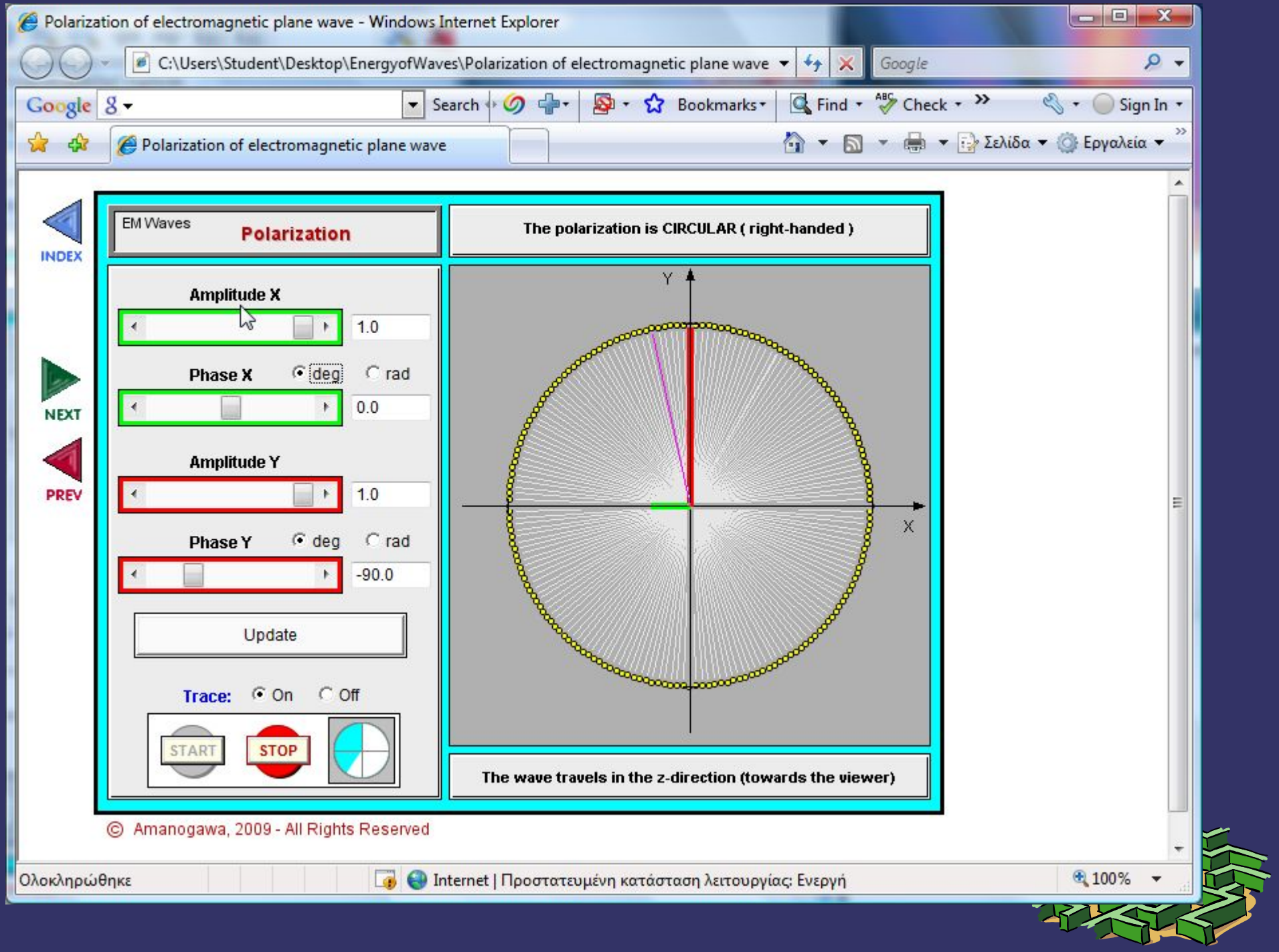

Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.011 T + 1 T
ω t = 4° + 2π
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = 90.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
CIRCULAR POLARIZATION
LEFT HANDED
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = 1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -4.71239 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is ELLIPTICAL (left-handed)
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
1.0
Phase Y
deg
rad
90.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.028 T
ω t = 10°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = -90.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
CIRCULAR POLARIZATION
RIGHT HANDED
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -7.85398 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.083 T
ω t = 30°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
$E_x = 1.0\ E_o$
$E_y = 1.0\ E_o$
$\varphi(E_y) - \varphi(E_x) = -90.0°$
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^{-9} [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^{-1}]
CIRCULAR POLARIZATION
RIGHT HANDED
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 1.0 [V/m]
$\angle E_y$ = -1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 1.0 λ = 0.29979 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -6.28319 [rad]
$|E_y|$ = 1.0 [V/m]
$\angle E_y$ = -7.85398 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.194 T
ω t = 70°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
z
0
z_A
z_B
L = 1.0 λ
Input
Update
Frequency f = 1.0E9 [Hz]
Relative Permittivity ε_r = 1.0
Relative Permeability μ_r = 1.0
Reference Amplitude E_o = 1.0 [V/m]
Reference Phase (z=0) φ = 0.0 [rad]
Length Displayed L = 1.0 [λ]
E_x = 1.0 E_o
E_y = 1.0 E_o
φ (E_y) - φ (E_x) = -90.0°
Output
WaveLength λ = 0.29979 [m]
Phase Velocity v_p = 2.99792 x 10^8 [m/s]
Period T = 1.0 x 10^-9 [s]
Impedance of the Medium [Ω]
η = 376.730313
Phase Constant
β = 20.95845 [m^-1]
CIRCULAR POLARIZATION
RIGHT HANDED
A) z_A = 0.0 λ = 0.0 [m]
|E_x| = 1.0 [V/m]
∠E_x = 0.0 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -1.5708 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
E_x(t) E_y(t) E_tot(t)
B) z_B = 1.0 λ = 0.29979 [m]
|E_x| = 1.0 [V/m]
∠E_x = -6.28319 [rad]
|E_y| = 1.0 [V/m]
∠E_y = -7.85398 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is CIRCULAR (right-handed)
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
1.0
Phase Y
deg
rad
-90.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Polarization of electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave

Polarization of electromagnetic plane wave

INDEX

NEXT

PREV

EM Waves

Polarization

The polarization is ELLIPTICAL (left-handed)

Amplitude X

1.0

Phase X deg rad

0.0

Amplitude Y

1.0

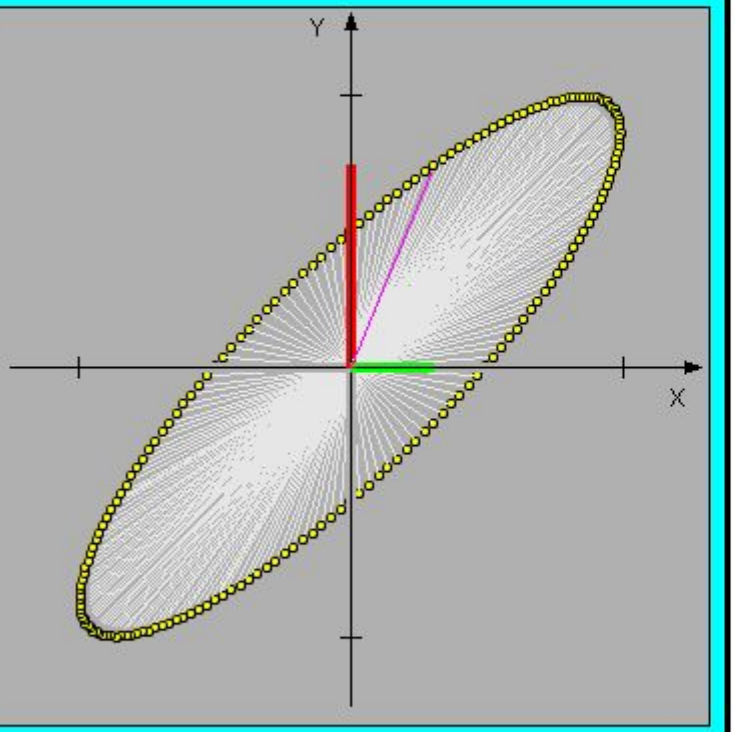
Phase Y deg rad

30.0

Update

Trace: On Off

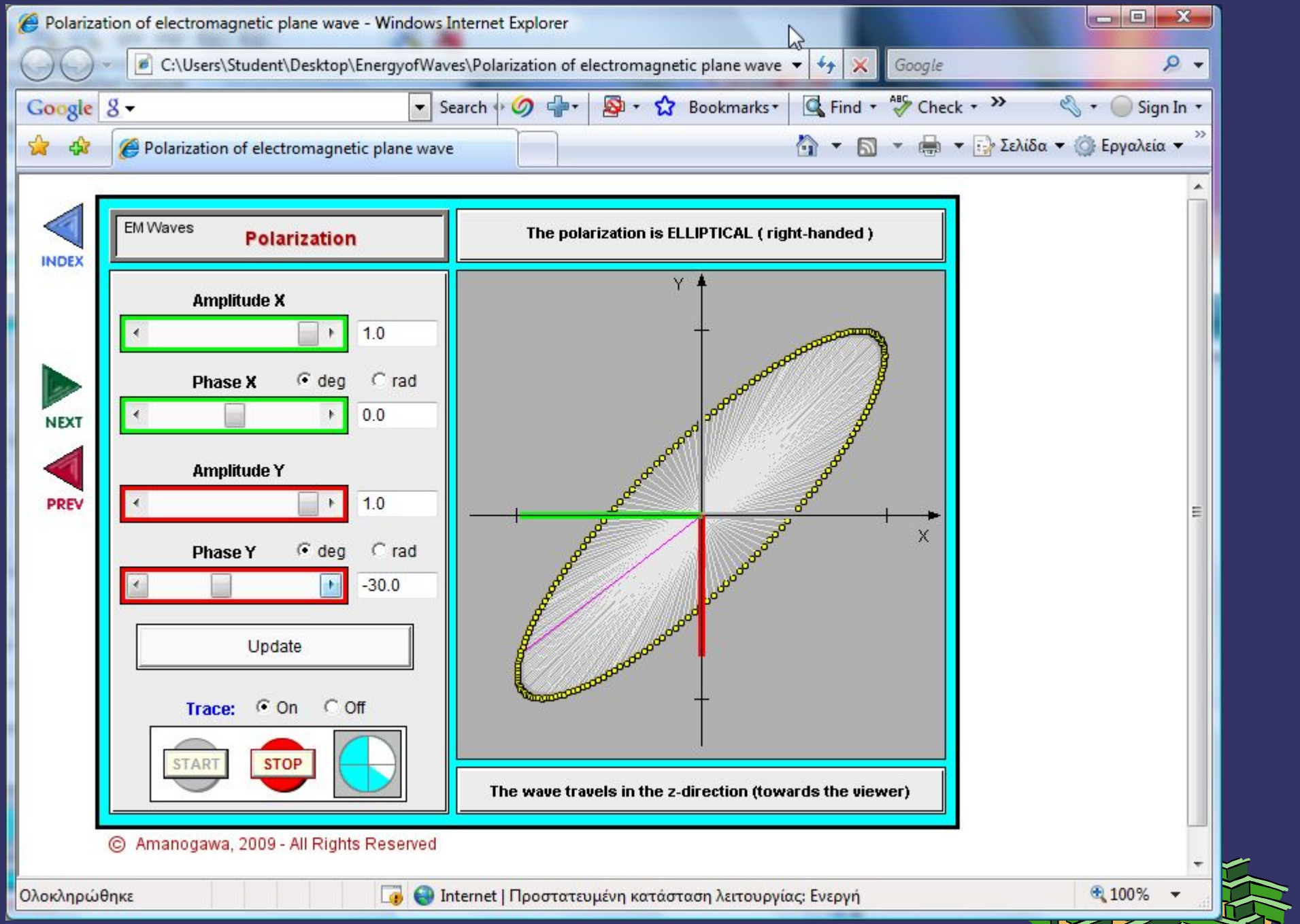
START STOP

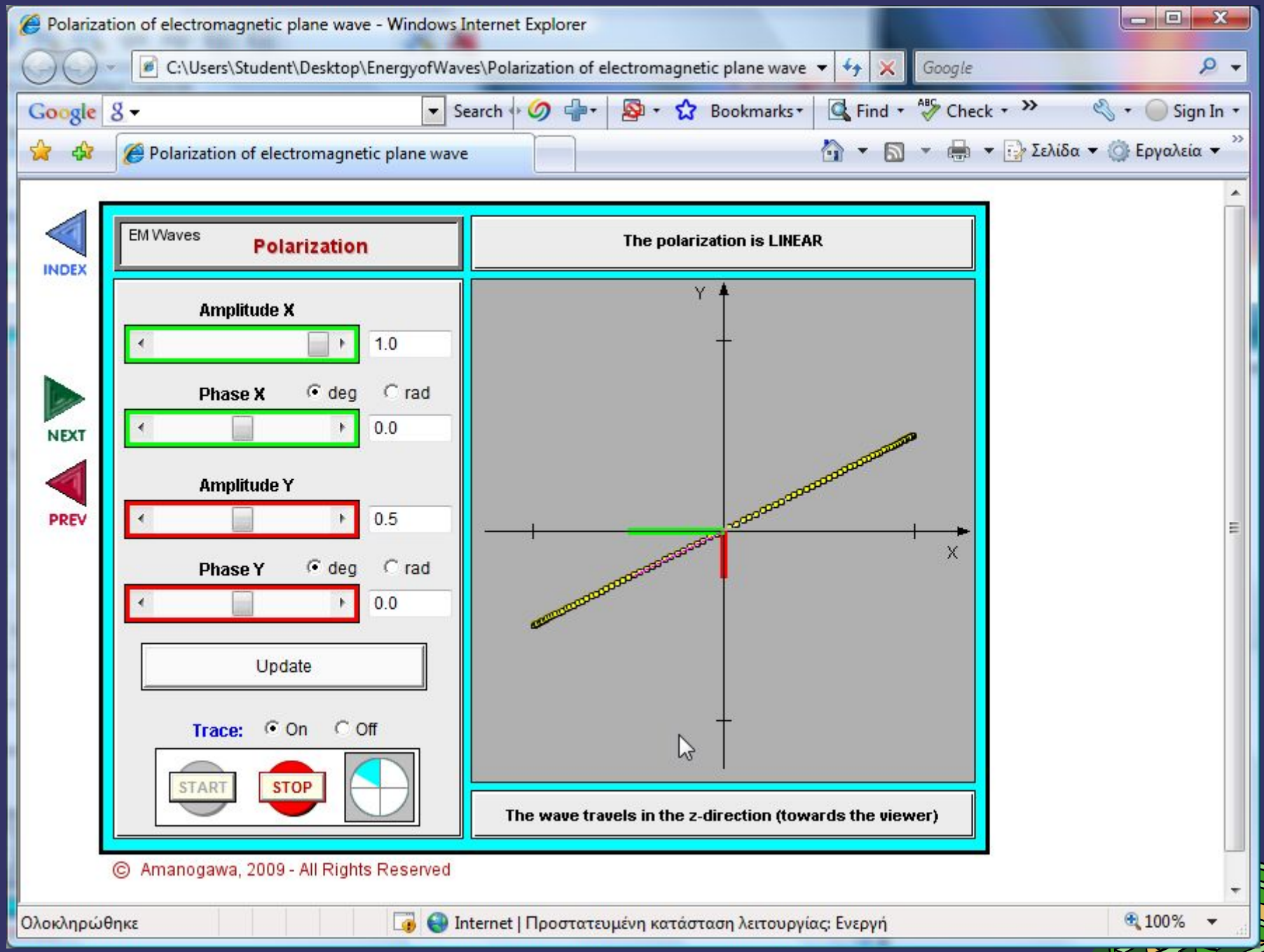


The wave travels in the z-direction (towards the viewer)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή 100%


Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is ELLIPTICAL (right-handed)
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
1.0
Phase Y
deg
rad
-30.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization of electromagnetic plane wave - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave
Google
Search
Bookmarks
Find
Check
Sign In
Polarization of electromagnetic plane wave
Σελίδα
Εργαλεία
INDEX
NEXT
PREV
EM Waves
Polarization
The polarization is LINEAR
Amplitude X
1.0
Phase X
deg
rad
0.0
Amplitude Y
0.5
Phase Y
deg
rad
0.0
Update
Trace:
On
Off
START
STOP
Y
X
The wave travels in the z-direction (towards the viewer)
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Polarization of electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave

Polarization of electromagnetic plane wave

INDEX

NEXT

PREV

EM Waves

Polarization

The polarization is ELLIPTICAL (left-handed)

Amplitude X

1.0

Phase X deg rad

0.0

Amplitude Y

0.5

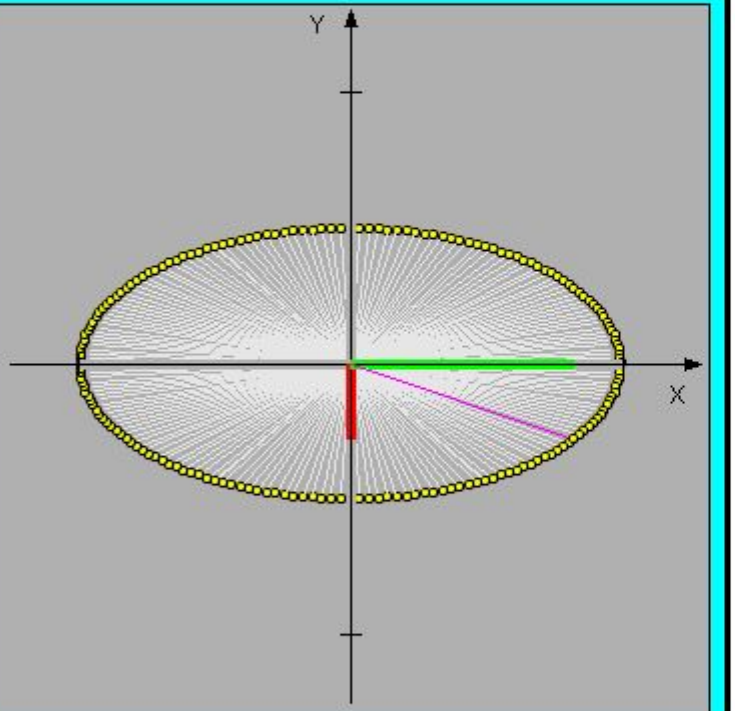
Phase Y deg rad

90.0

Update

Trace: On Off

START STOP



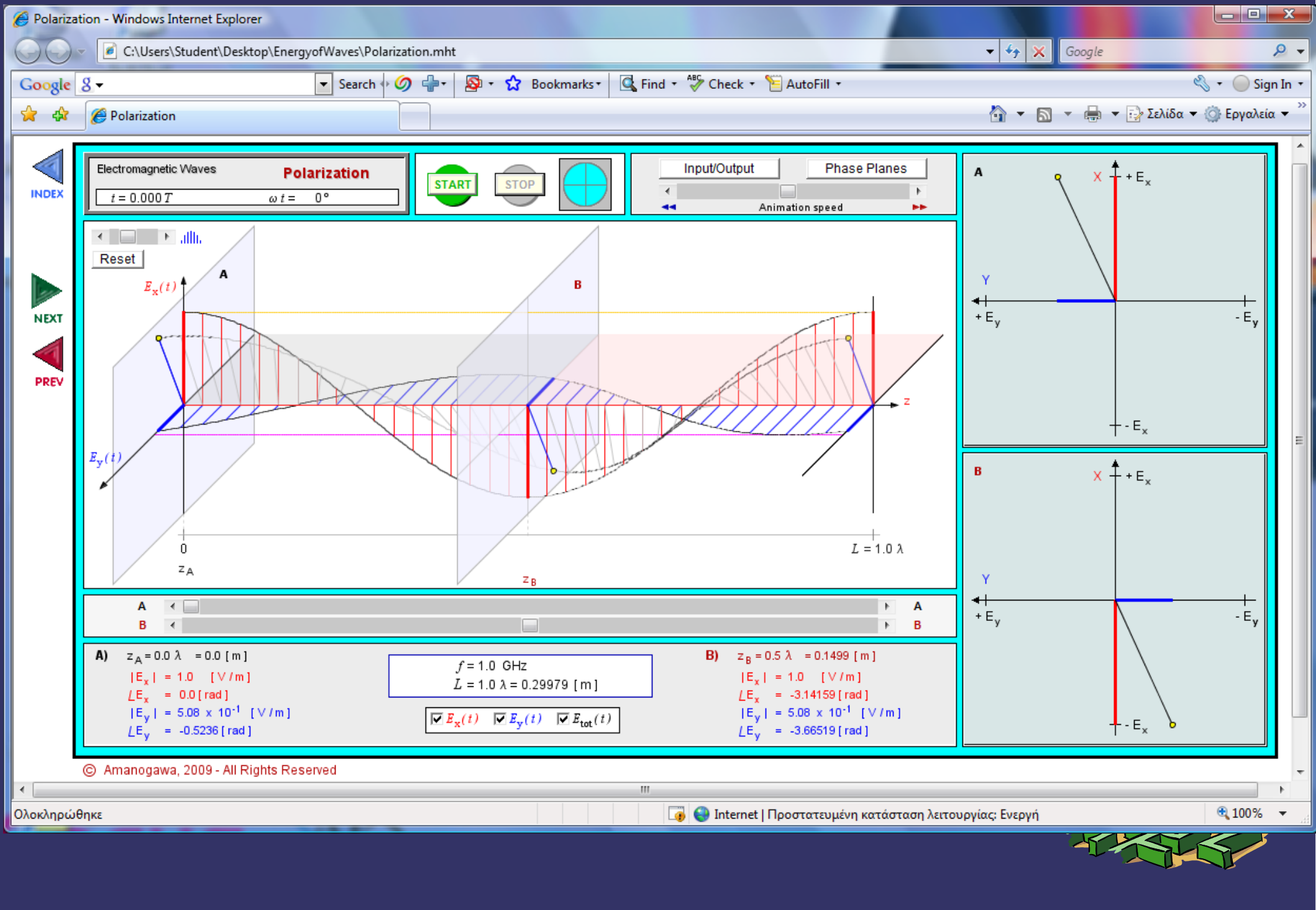
The wave travels in the z-direction (towards the viewer)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
Electromagnetic Waves
Polarization
t = 0.000 T
ω t = 0°
START
STOP
Input/Output
Phase Planes
Animation speed
INDEX
NEXT
PREV
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
$L = 1.0\ \lambda$
X
Y
+ E_x
- E_x
+ E_y
- E_y
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 0.5 λ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.056\,T$ $\omega t = 20°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.097\,T$ $\omega t = 35°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B

A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

☑ $E_x(t)$ ☑ $E_y(t)$ ☑ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A X $+E_x$ Y $+E_y$ $-E_y$ $-E_x$

B X $+E_x$ Y $+E_y$ $-E_y$ $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.139\,T$ $\omega t = 50°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B

A B

A) $z_A = 0.0\ \lambda = 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

☑ $E_x(t)$ ☑ $E_y(t)$ ☑ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda = 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.181\ T$ $\omega t = 65°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda = 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

☑ $E_x(t)$ ☑ $E_y(t)$ ☑ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda = 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X $+E_x$, Y $+E_y$ $-E_y$ $-E_x$

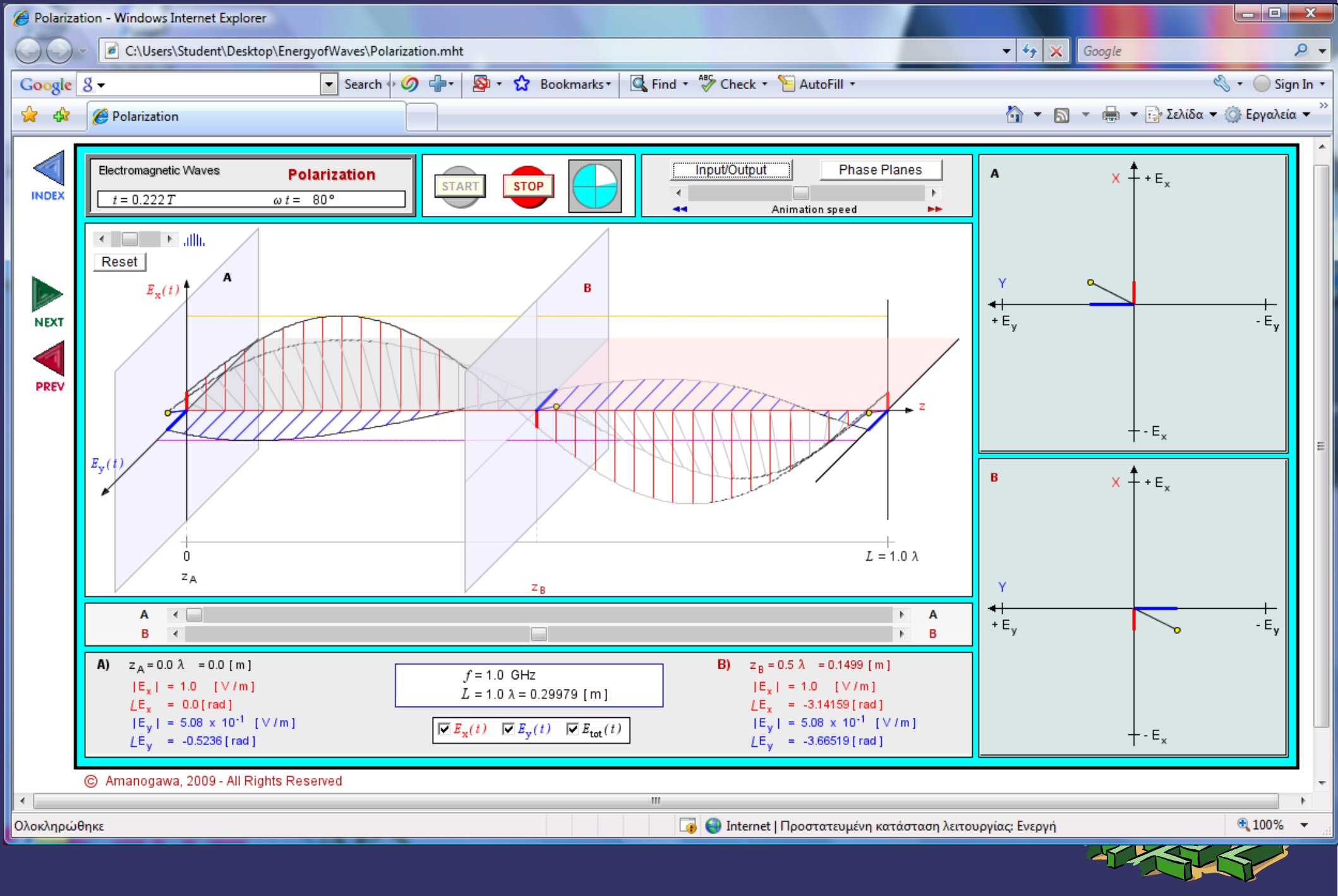
B: X $+E_x$, Y $+E_y$ $-E_y$ $-E_x$

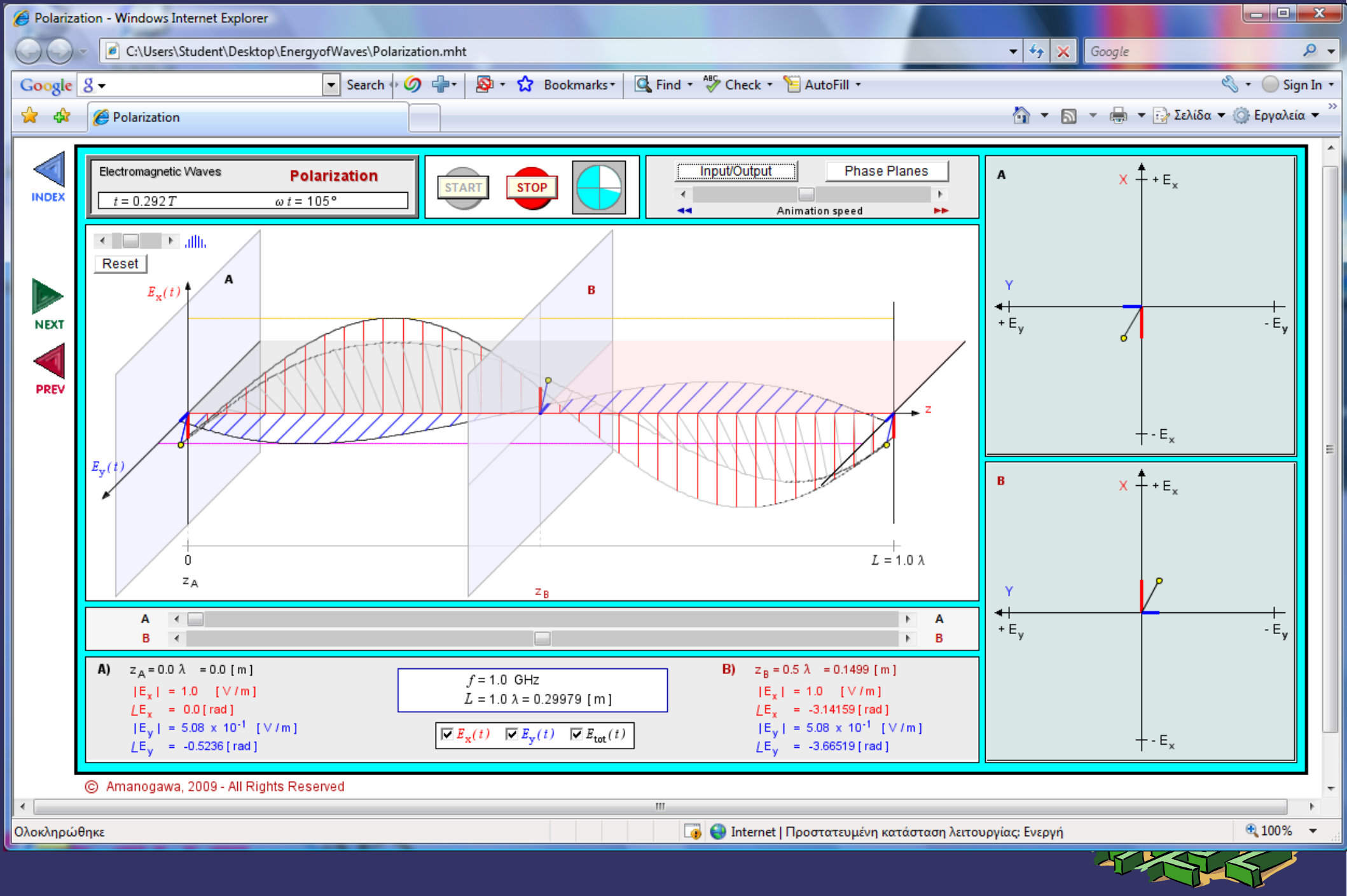
© Amanogawa, 2009 - All Rights Reserved

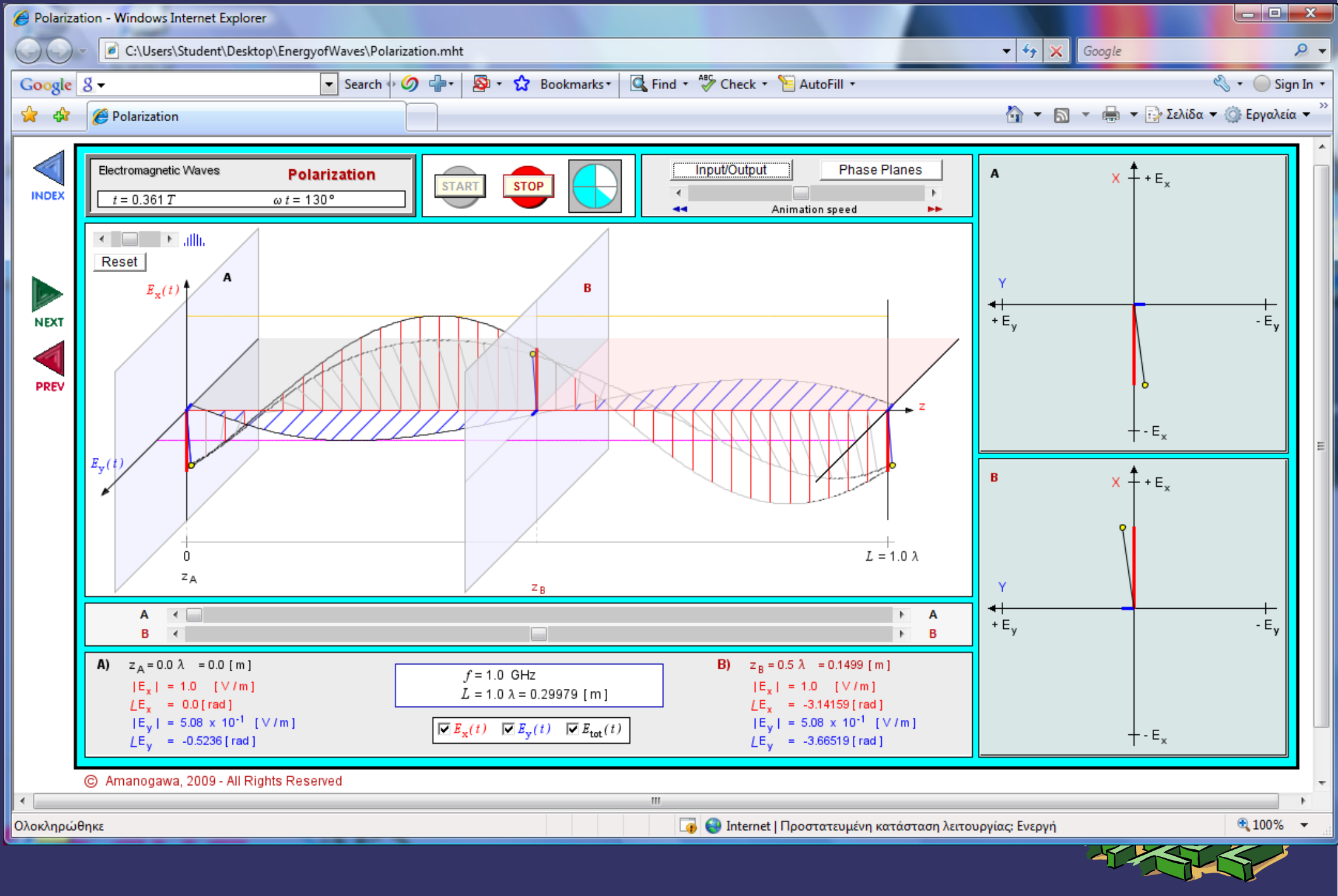
Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.222 T
ω t = 80°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 0.5 λ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
X
Y
+ E_x
- E_x
+ E_y
- E_y
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.292 T
ω t = 105°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
$L = 1.0\ \lambda$
X
+ E_x
- E_x
Y
+ E_y
- E_y
A) $z_A = 0.0\ \lambda$ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
$L = 1.0\ \lambda = 0.29979$ [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) $z_B = 0.5\ \lambda$ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.361 T
ω t = 130°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 0.5 λ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
X
Y
+ E_x
- E_x
+ E_y
- E_y
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.403\,T$ $\omega t = 145°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.431\ T$ $\omega t = 155°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.514\,T$ $\omega t = 185°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X $+E_x$ $-E_x$ Y $+E_y$ $-E_y$

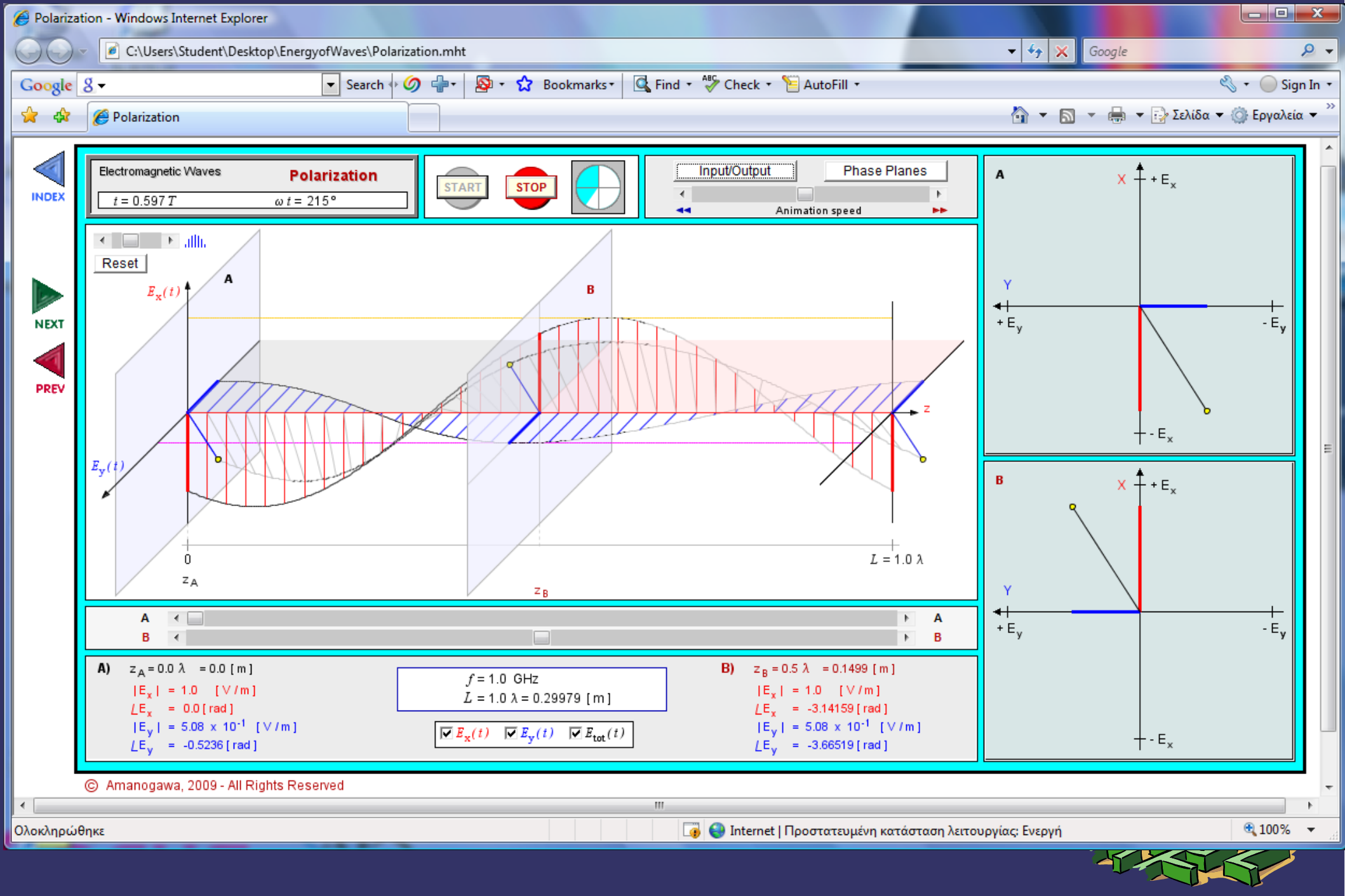
B: X $+E_x$ $-E_x$ Y $+E_y$ $-E_y$

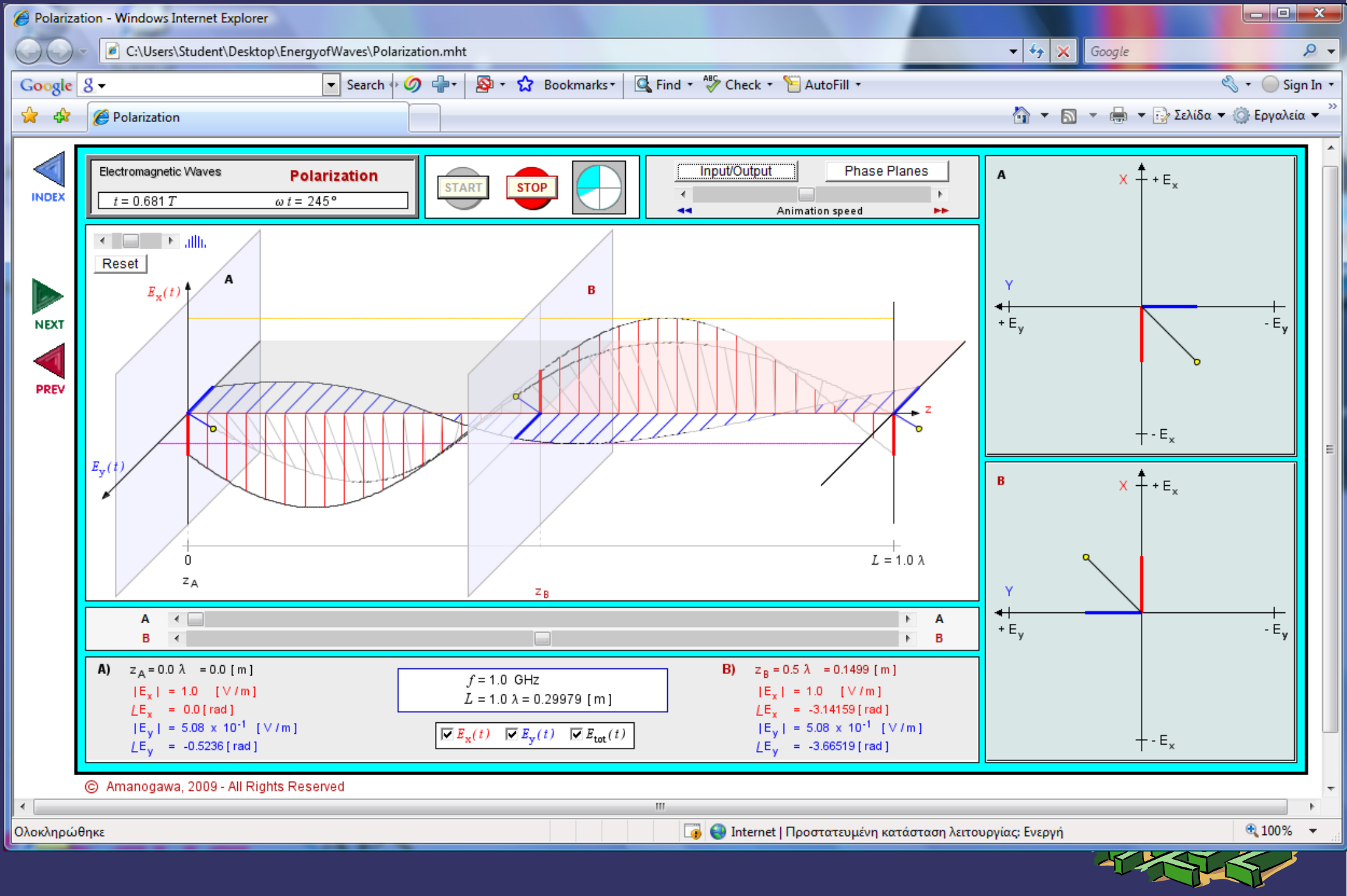
© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
Electromagnetic Waves
Polarization
t = 0.597 T
ω t = 215°
START
STOP
Input/Output
Phase Planes
Animation speed
INDEX
NEXT
PREV
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 0.5 λ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
X
Y
+ E_x
- E_x
+ E_y
- E_y
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%


Polarization - Windows Internet Explorer
C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht
Polarization
INDEX
NEXT
PREV
Electromagnetic Waves
Polarization
t = 0.681 T
ω t = 245°
START
STOP
Input/Output
Phase Planes
Animation speed
Reset
A
B
$E_x(t)$
$E_y(t)$
z
0
z_A
z_B
L = 1.0 λ
A) z_A = 0.0 λ = 0.0 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = 0.0 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -0.5236 [rad]
f = 1.0 GHz
L = 1.0 λ = 0.29979 [m]
$E_x(t)$ $E_y(t)$ $E_{tot}(t)$
B) z_B = 0.5 λ = 0.1499 [m]
$|E_x|$ = 1.0 [V/m]
$\angle E_x$ = -3.14159 [rad]
$|E_y|$ = 5.08 x 10^{-1} [V/m]
$\angle E_y$ = -3.66519 [rad]
X
Y
+ E_x
- E_x
+ E_y
- E_y
© Amanogawa, 2009 - All Rights Reserved
Ολοκληρώθηκε
Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή
100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.750\,T$ $\omega t = 270°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization.mht

Polarization

INDEX

NEXT

PREV

Electromagnetic Waves **Polarization**

$t = 0.833\,T$ $\omega t = 300°$

START STOP

Input/Output Phase Planes

Animation speed

Reset

$E_x(t)$ A B $E_y(t)$ z

0 z_A z_B $L = 1.0\ \lambda$

A B A B

A) $z_A = 0.0\ \lambda$ $= 0.0$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = 0.0$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -0.5236$ [rad]

$f = 1.0$ GHz

$L = 1.0\ \lambda = 0.29979$ [m]

$E_x(t)$ $E_y(t)$ $E_{tot}(t)$

B) $z_B = 0.5\ \lambda$ $= 0.1499$ [m]

$|E_x| = 1.0$ [V/m]

$\angle E_x = -3.14159$ [rad]

$|E_y| = 5.08 \times 10^{-1}$ [V/m]

$\angle E_y = -3.66519$ [rad]

A: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

B: X, $+E_x$, Y, $+E_y$, $-E_y$, $-E_x$

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

Polarization of electromagnetic plane wave - Windows Internet Explorer

C:\Users\Student\Desktop\EnergyofWaves\Polarization of electromagnetic plane wave

Polarization of electromagnetic plane wave

INDEX

NEXT

PREV

EM Waves

Polarization

The polarization is ELLIPTICAL (left-handed)

Amplitude X

1.0

Phase X deg rad

0.0

Amplitude Y

0.5

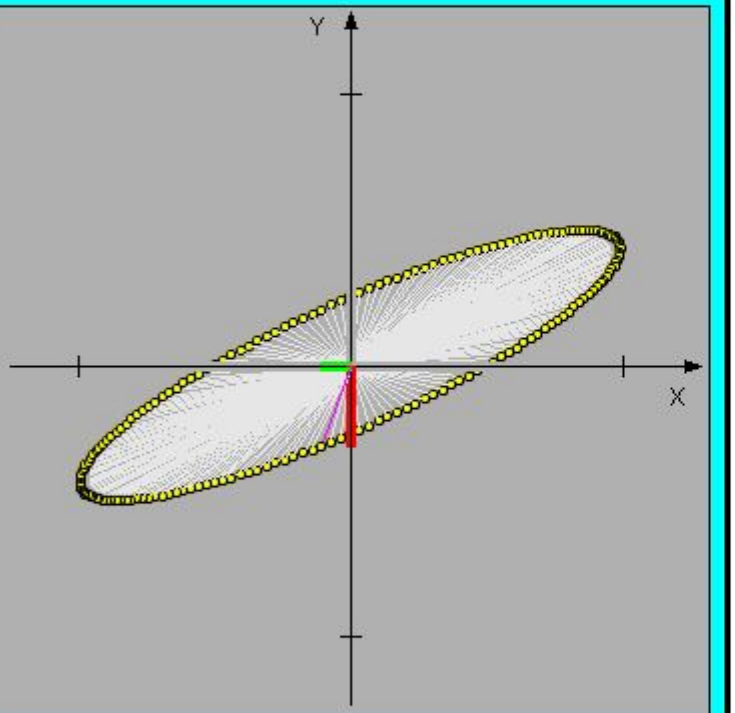
Phase Y deg rad

30.5

Update

Trace: On Off

START STOP



The wave travels in the z-direction (towards the viewer)

© Amanogawa, 2009 - All Rights Reserved

Ολοκληρώθηκε

Internet | Προστατευμένη κατάσταση λειτουργίας: Ενεργή

100%

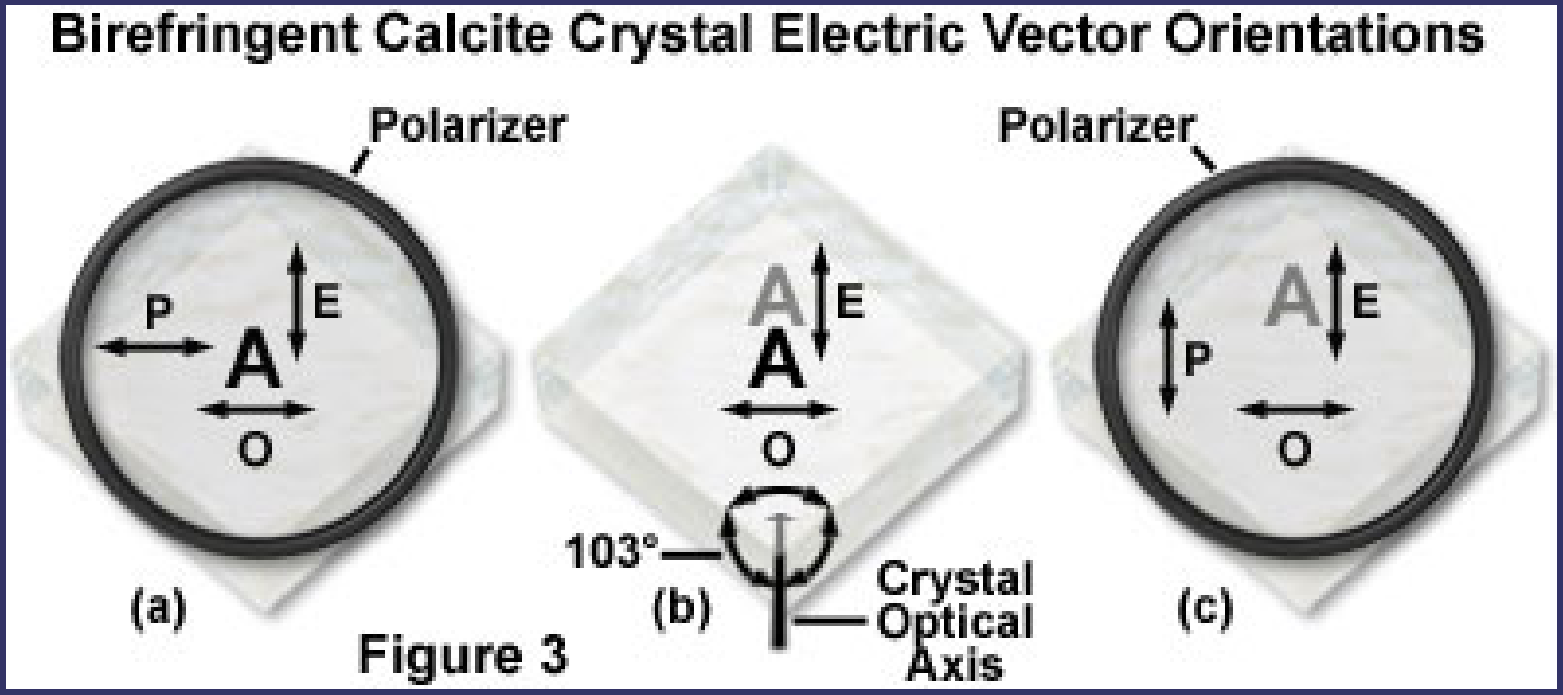


Figure 3

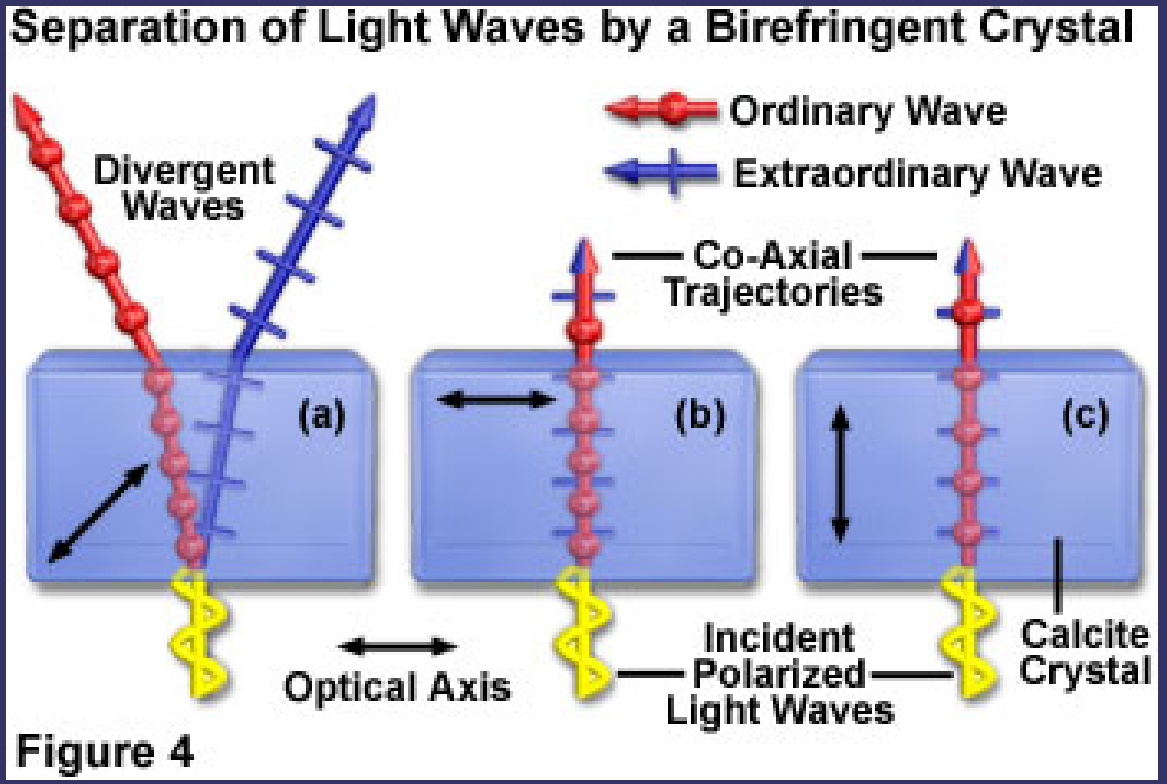
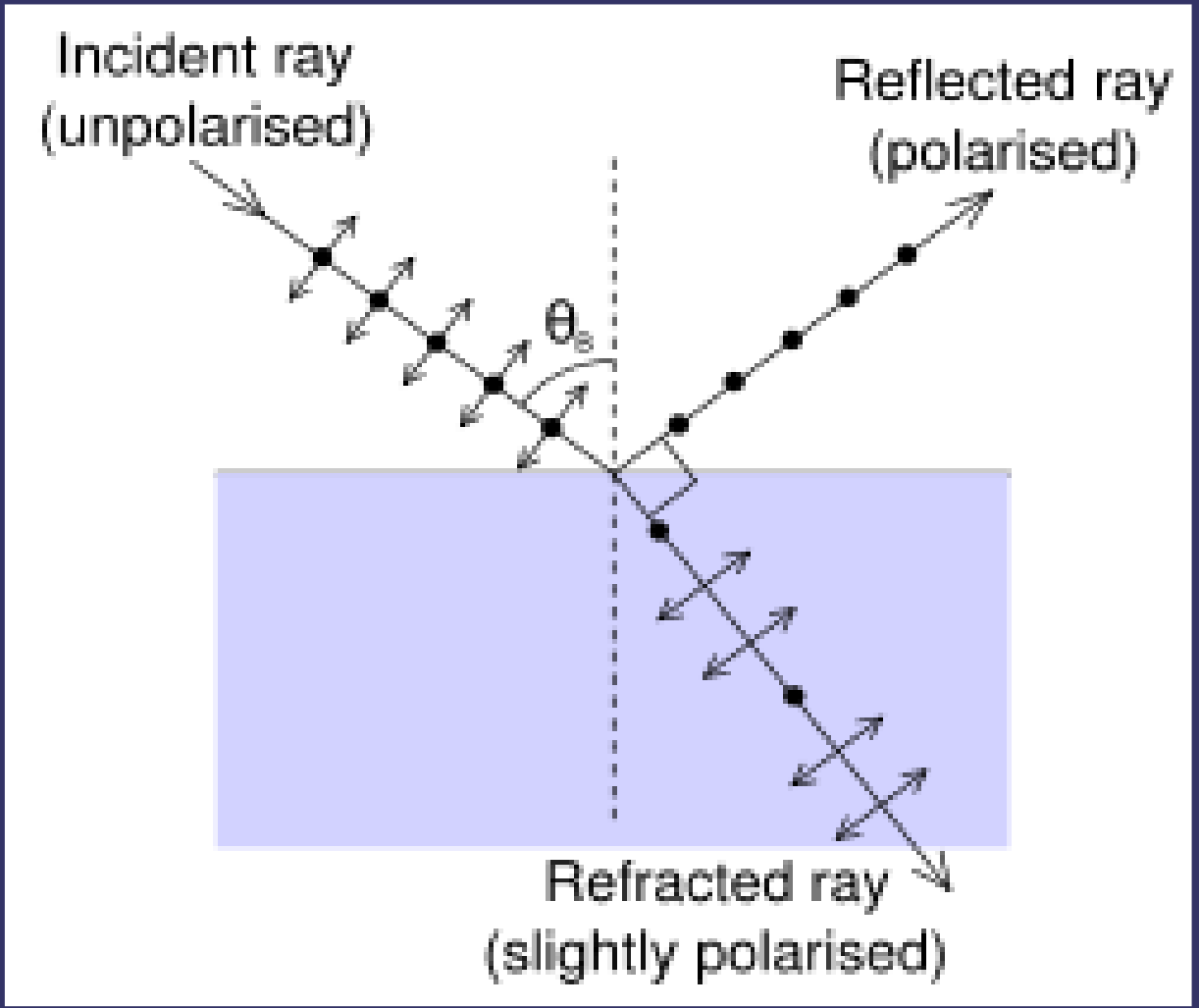
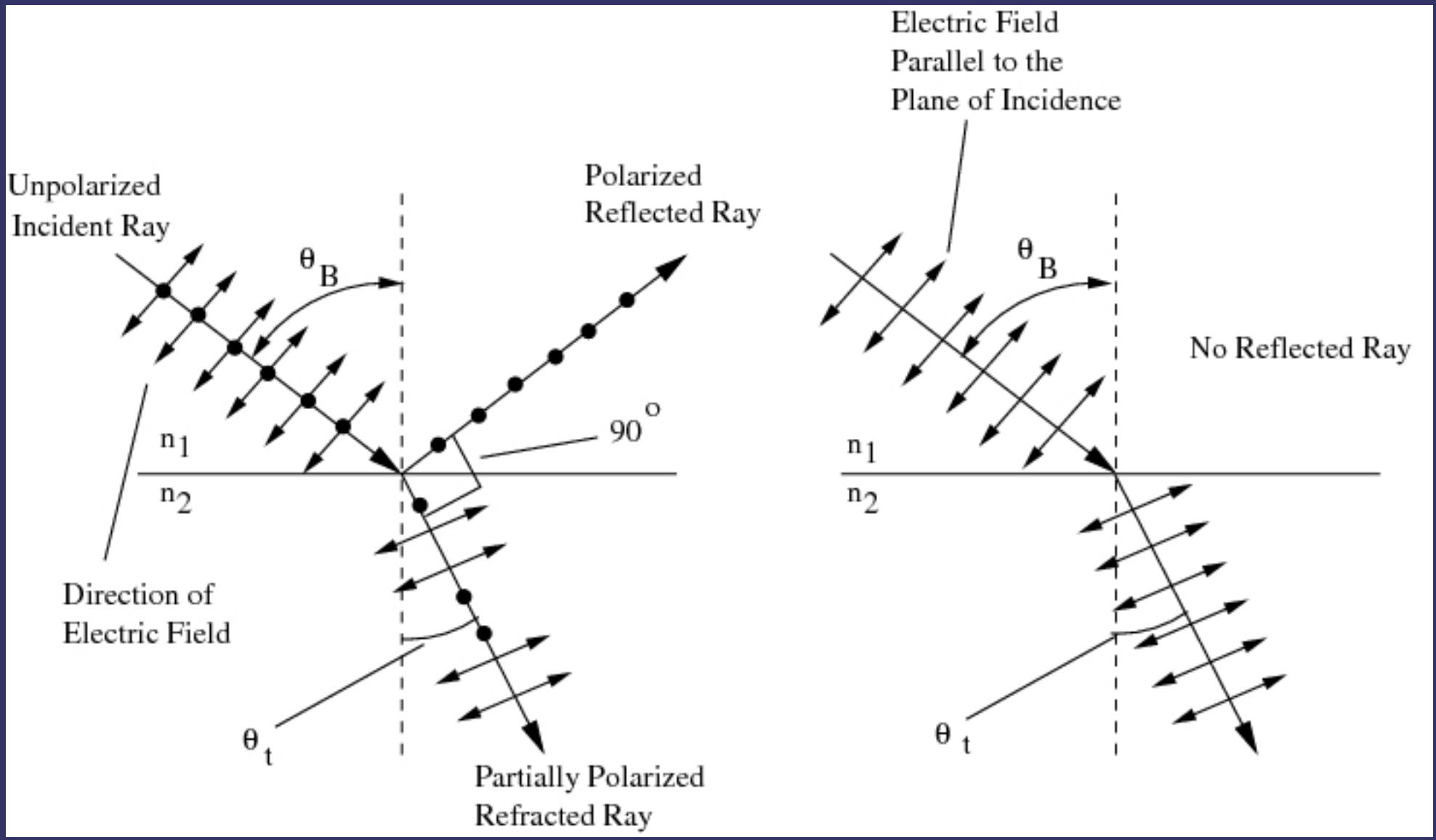
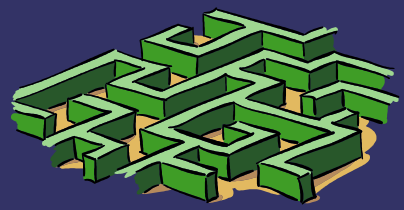


Figure 4

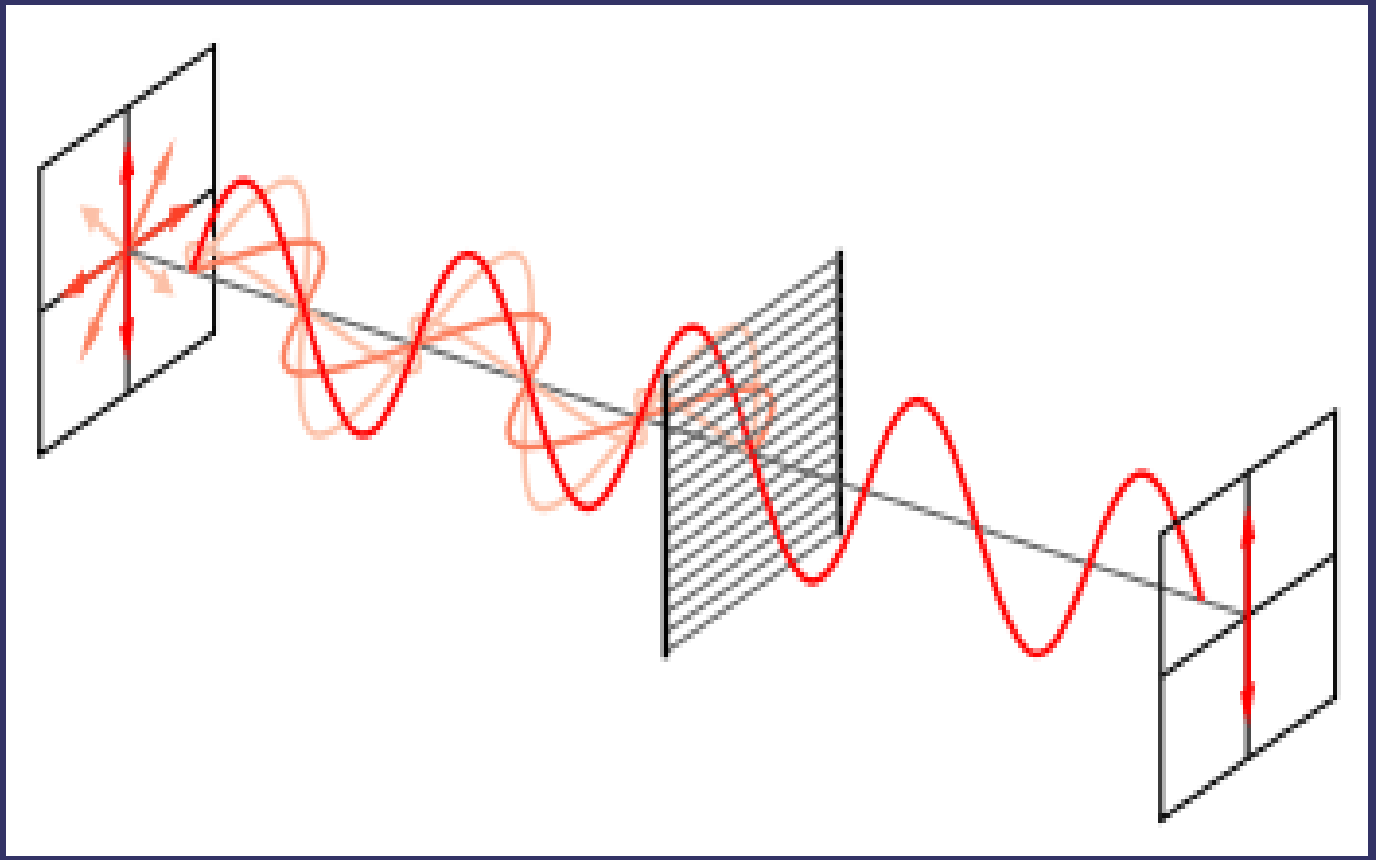
Η γωνία Brewster

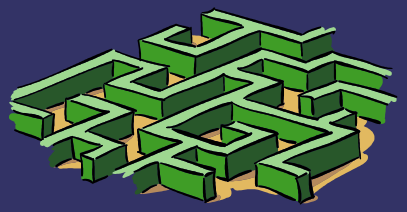


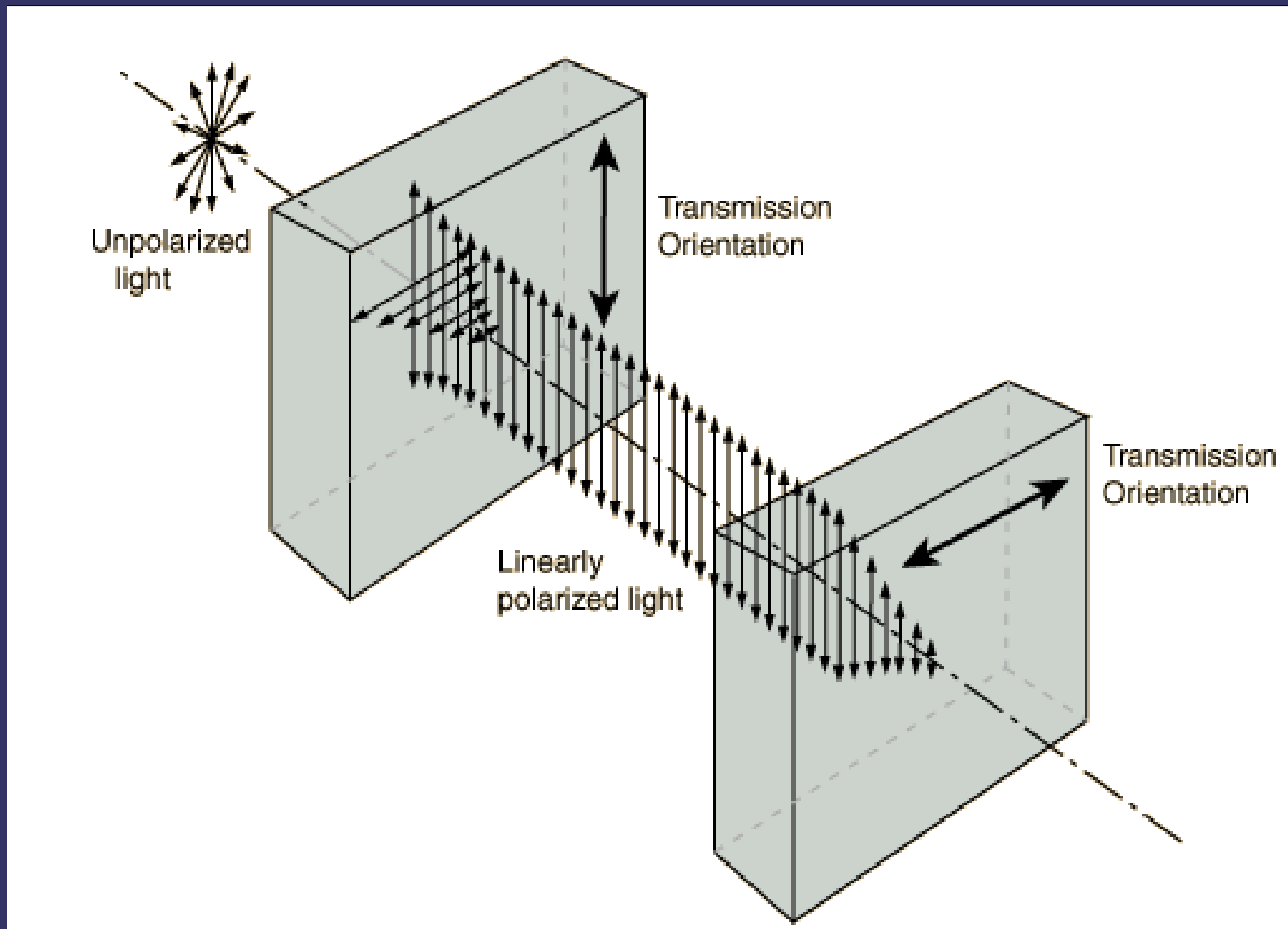

Unpolarized
Incident Ray
Polarized
Reflected Ray
θ B
90 o
n 1
n 2
Direction of
Electric Field
θ t
Partially Polarized
Refracted Ray
Electric Field
Parallel to the
Plane of Incidence
θ B
No Reflected Ray
n 1
n 2
θ t



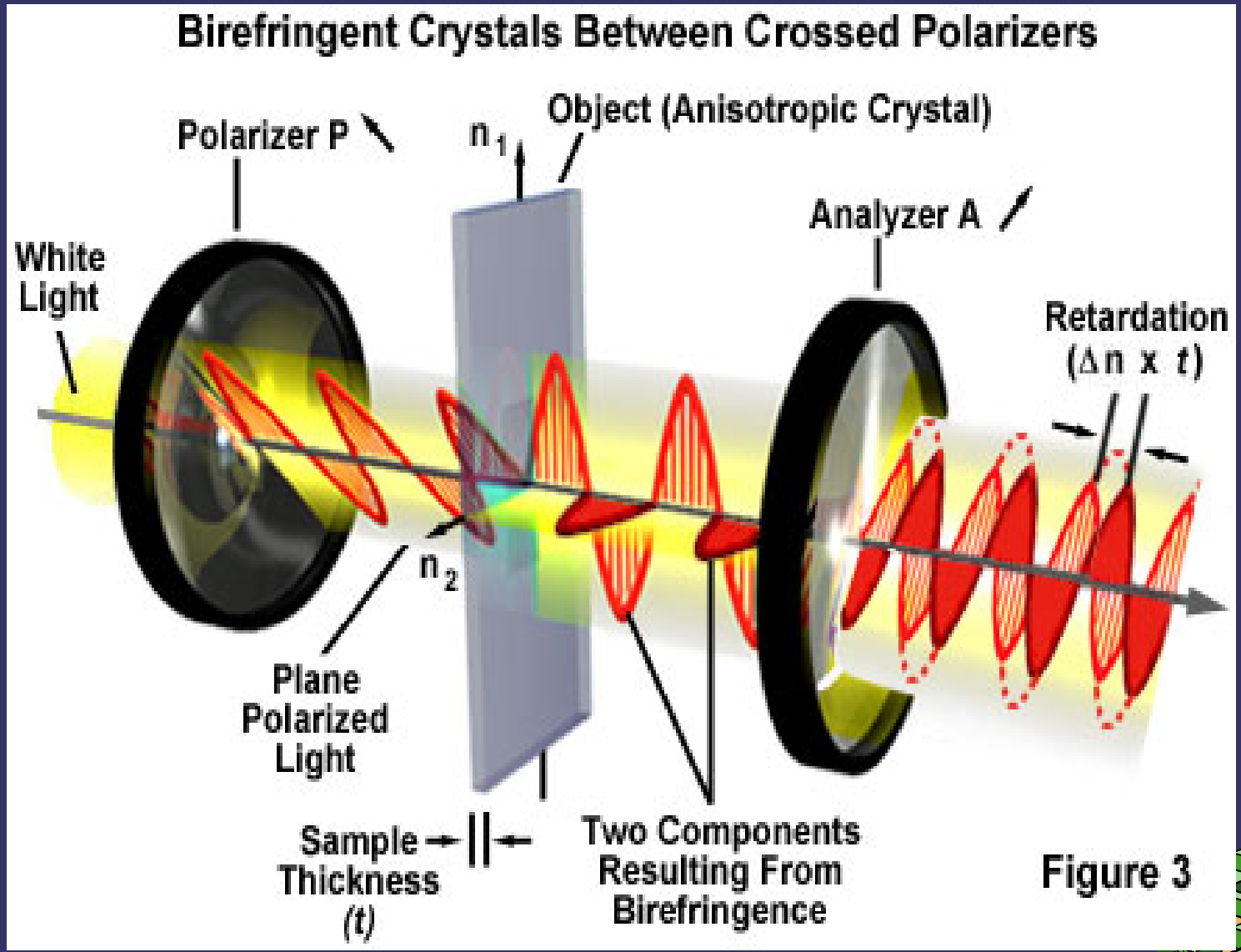
Πολωτής



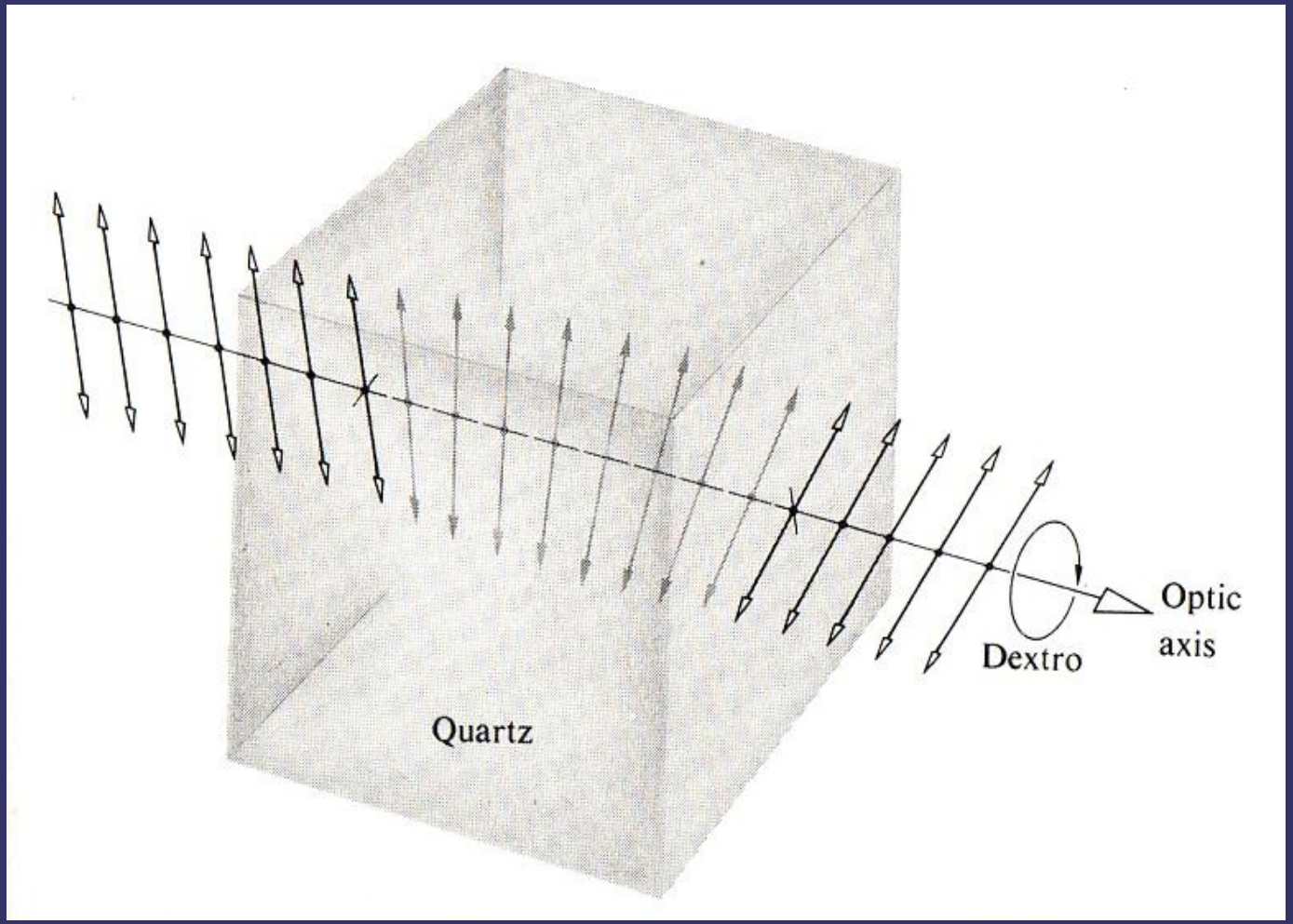


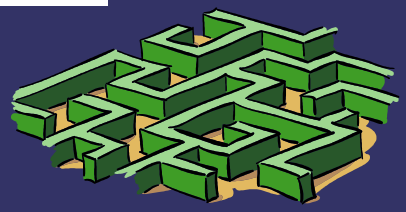

Unpolarized
light
Transmission
Orientation
Linearly
polarized light
Transmission
Orientation

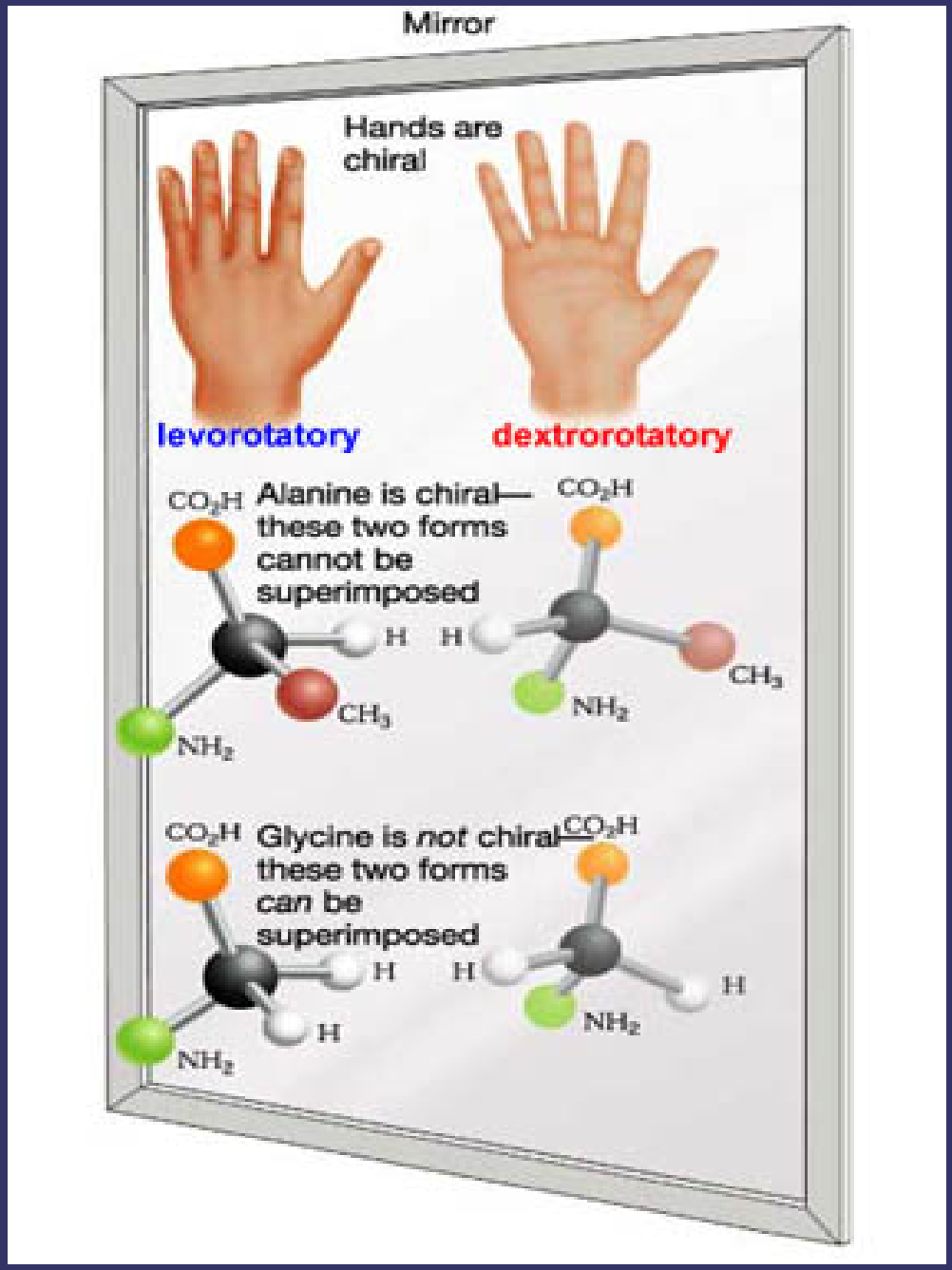
Πλακίδια καθυστέρησης φάσης

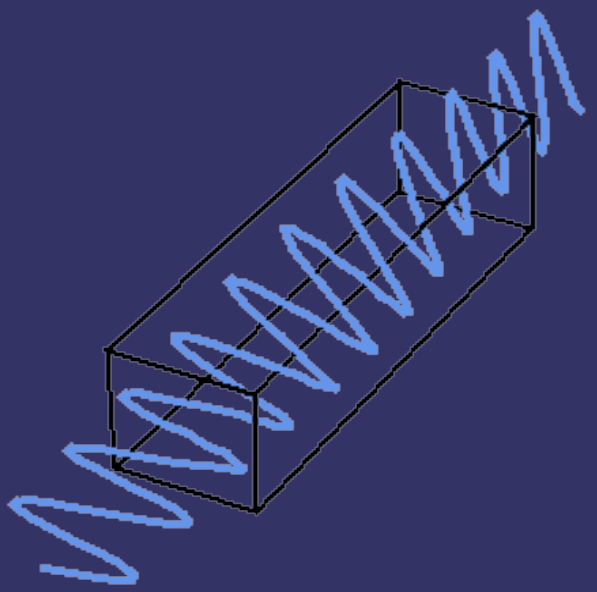


Οπτική ενεργότητα






Mirror
Hands are chiral
levorotatory
dextrorotatory
Alanine is chiral— these two forms cannot be superimposed
Glycine is not chiral— these two forms can be superimposed



Καθημερινές Εφαρμογές

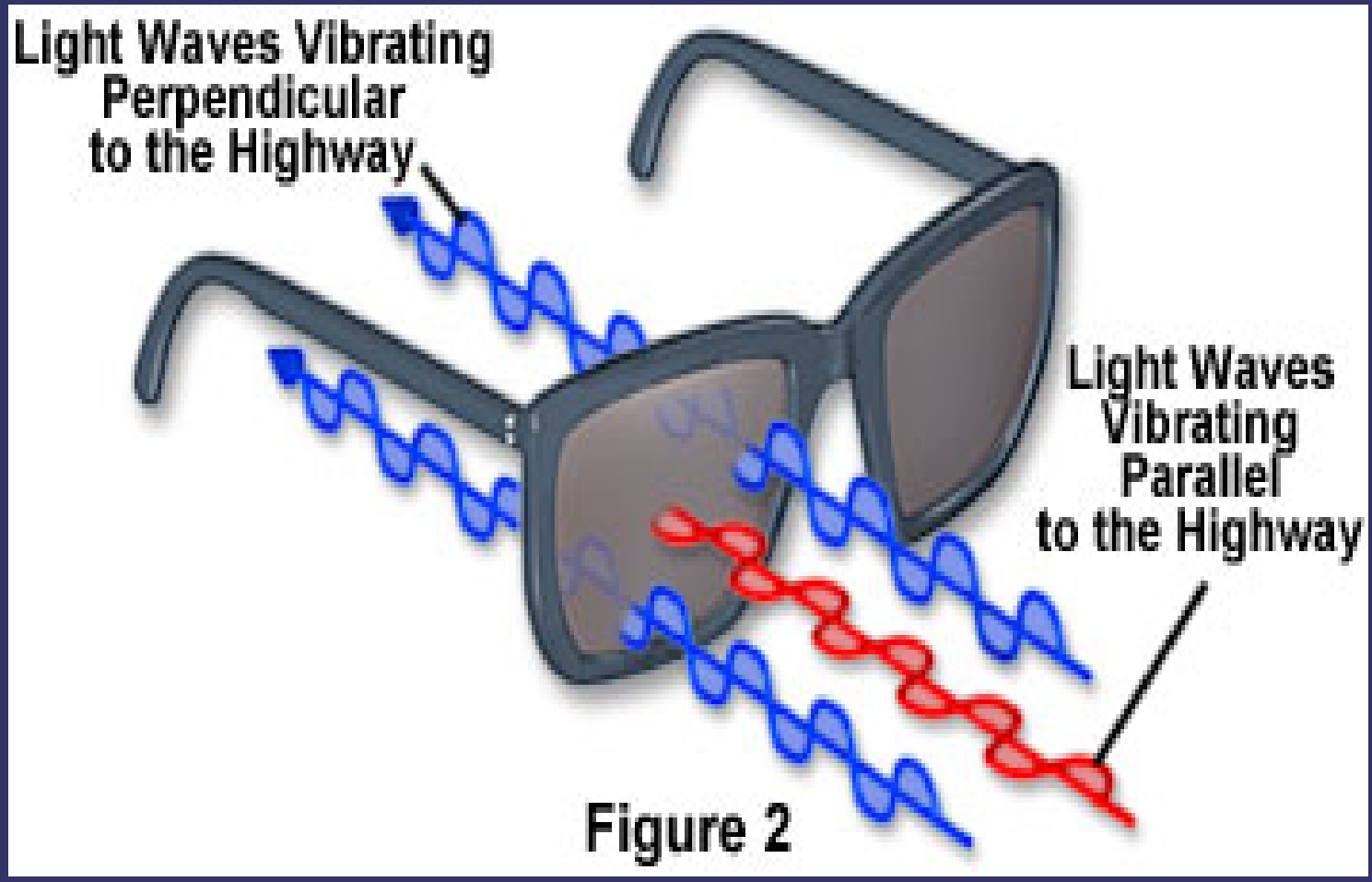


Figure 2

Καθημερινές Εφαρμογές

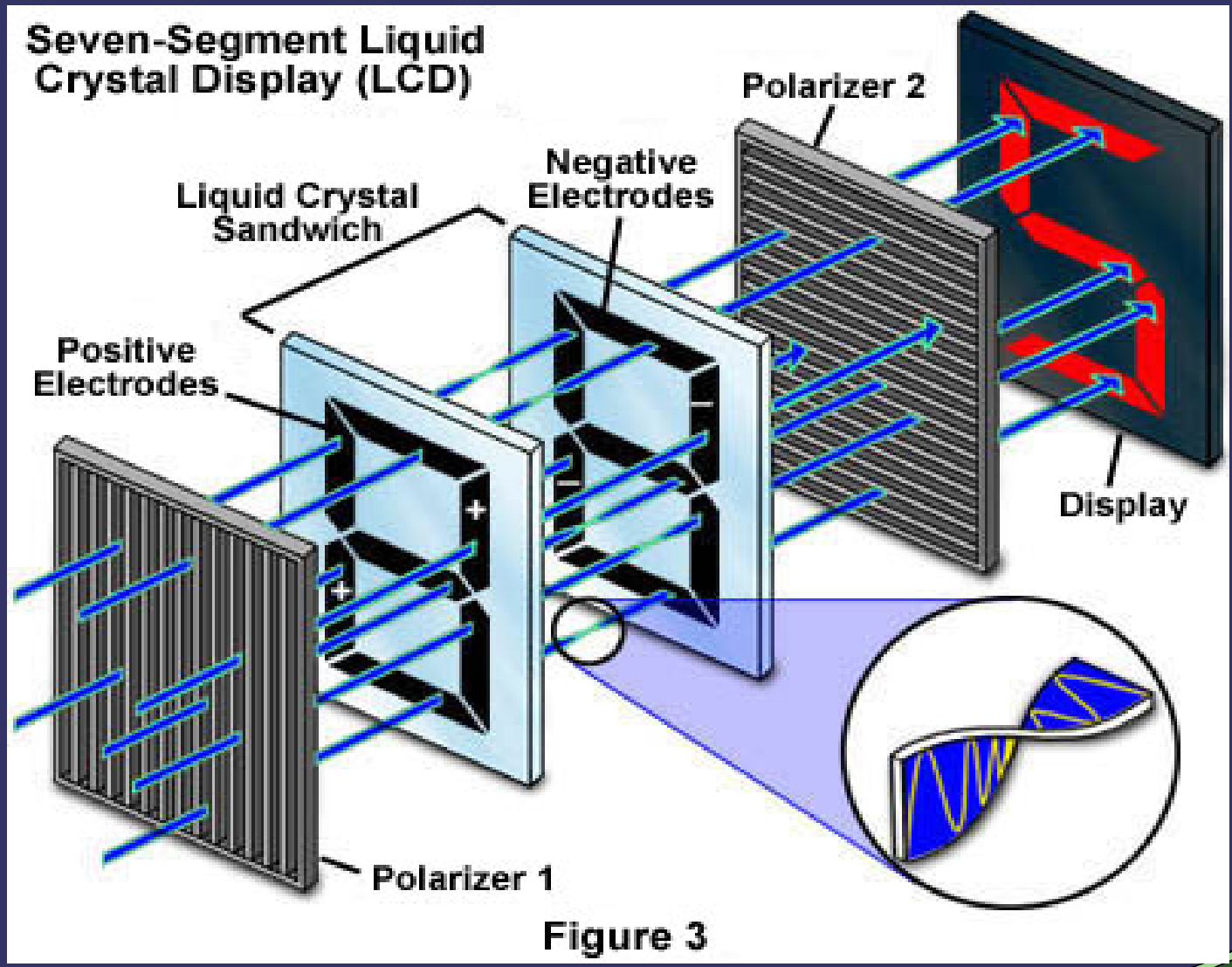


Figure 3