

Ansys HFSS

Presentación orientada para el laboratorio de Ondas
Electromagnéticas

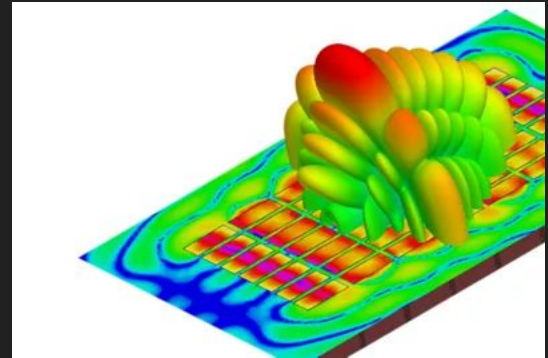
The Ansys logo features a stylized 'A' composed of two slanted parallel bars, one orange and one white, followed by the word 'nsys' in a white, bold, sans-serif font.

Ansys

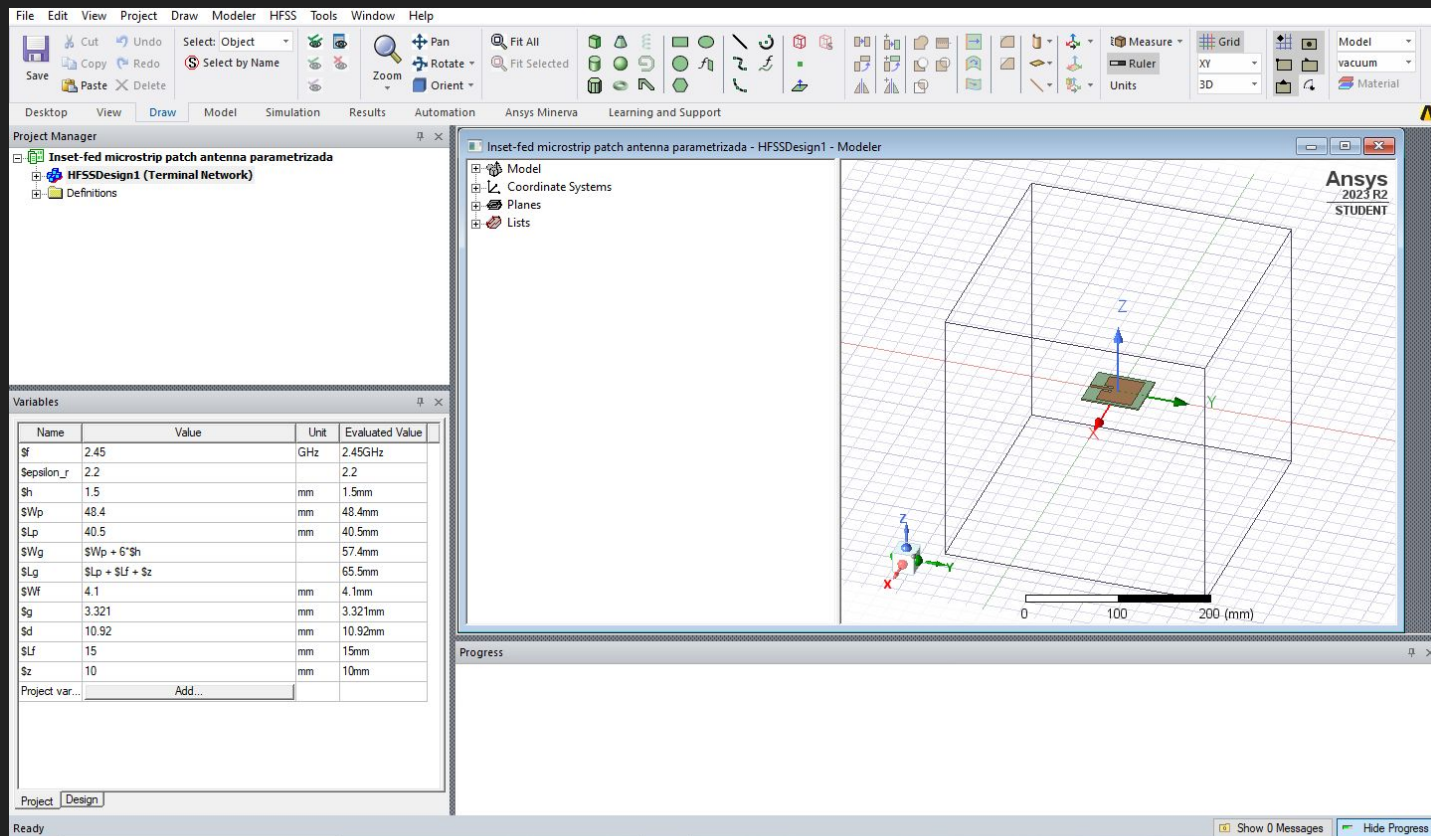
H F S S

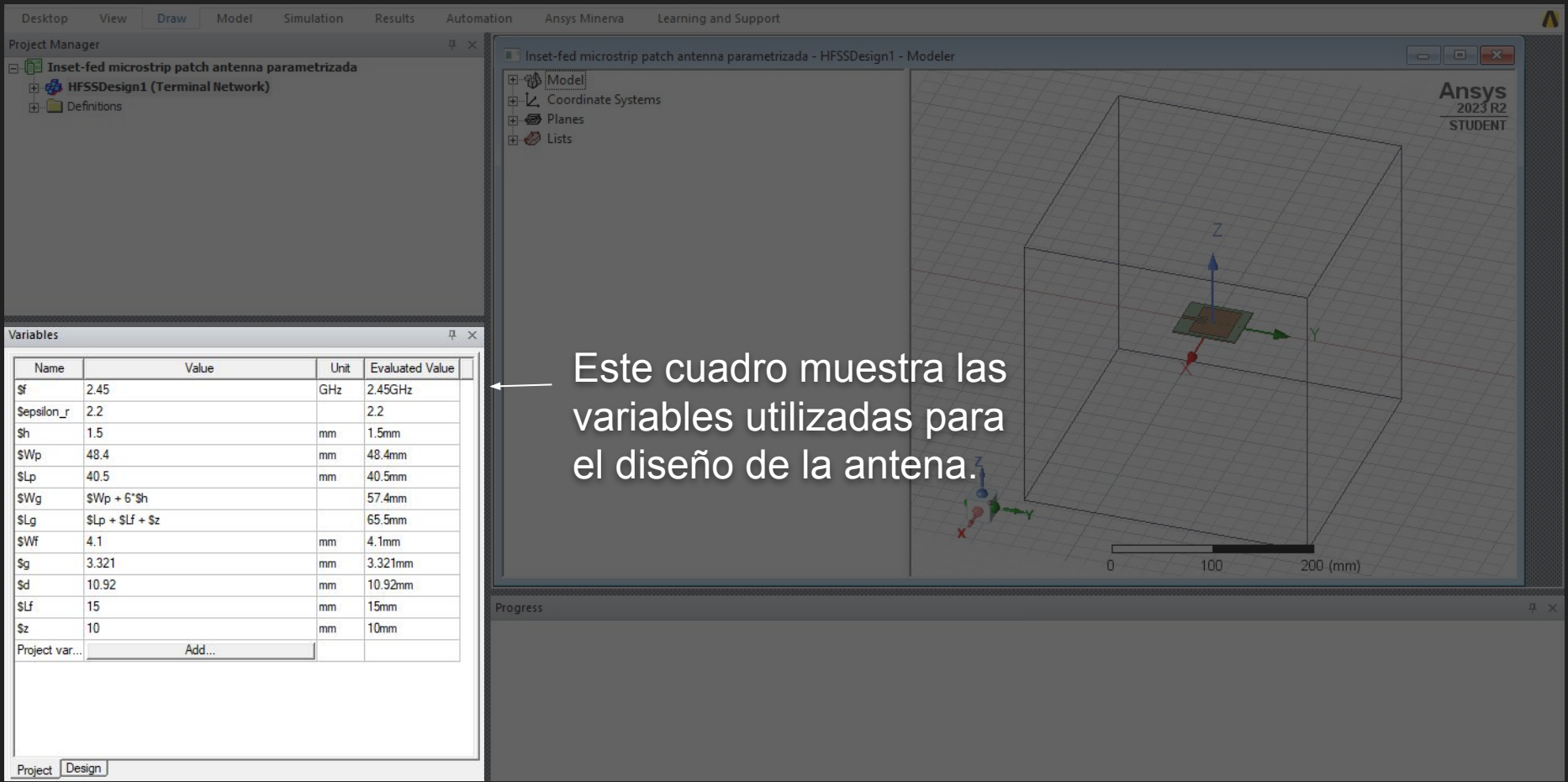
¿Que es Ansys HFSS?

Ansyz HFSS (High-Frequency Structure Simulator) es un software de simulación electromagnética (EM) en 3D para diseñar y simular productos electrónicos de alta frecuencia como antenas, arreglos de antenas, componentes RF o de microondas, interconexiones de alta velocidad, filtros, conectores, paquetes de circuitos integrados y placas de circuitos impresos.



¿Cómo utilizar Ansys HFSS?





Este cuadro muestra las variables utilizadas para el diseño de la antenna.

Ansys Electronics Desktop Student 2023 R2 - Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - 3D Modeler - SOLVED

File Edit View **Project** Draw Modeler HFSS Tools Window Help

Save Cut Copy Paste Desktop View

Project Manager

- Insert HFSS Design
- Insert Q3D Extractor Design
- Insert 2D Extractor Design
- Insert Maxwell 3D Design
- Insert Maxwell 2D Design
- Insert RMxpert Design
- Insert Maxwell Circuit Design
- Insert Icepak Design
- Insert Circuit Design
- Insert Simplorer Design
- Insert Documentation File...
- Analyze All
- Submit Job...
- Project Variables...**
- Datasets...
- Event Callbacks...

HFSSDesign1

Model

Coordinate Systems

Planes

Lists

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler

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0 100 200 (mm)

Progress

Design

Para agregar, borrar o editar una variable, o añadir a los parámetros de la optimización, se debe de entrar a esta opción.

Name	Value	Unit	Evaluated Value
2.45	2.45	GHz	2.45GHz
2.2	2.2		2.2
1.5	1.5	mm	1.5mm
48.4	48.4	mm	48.4mm
40.5	40.5	mm	40.5mm
\$Wp + 6*\$h			57.4mm
\$Lp + \$Lf + \$z			65.5mm
4.1	4.1	mm	4.1mm
3.321	3.321	mm	3.321mm
10.92	10.92	mm	10.92mm
15	15	mm	15mm
10	10	mm	10mm

Desktop View Draw Model Simulation Results Automation Ansys Minerva Learning and Support

Project Manager

Inset-fed microstrip patch antenna parametrizada

- HFSSDesign1 (Terminal Network)
- Definitions

Variables

Name	Value	Unit	Evaluated Value
\$f	2.45	GHz	2.45GHz
\$epsilon_r	2.2		2.2
\$h	1.5	mm	1.5mm
\$Wp	48.4	mm	48.4mm
\$Lp	40.5	mm	40.5mm
\$Wg	$SWp + 6 \cdot \$h$		57.4mm
\$Lg	$SLp + SLf + Sz$		65.5mm
\$Wf	4.1	mm	4.1mm
\$g	3.321	mm	3.321mm
\$d	10.92	mm	10.92mm
\$Lf	15	mm	15mm
\$z	10	mm	10mm

Project var... Add...

Project Design

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler

Model

- Solids
 - air
 - Box1
 - Rogers RT/duroid 5880 (tm)
- Sheets
 - Lumped Port
 - Perfect E
 - GND
 - Patch
- Coordinate Systems
- Planes
- Lists

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Este recuadro muestra el modelo con el cual se construyó la antena. En la parte de perfect E, se pueden encontrar las geometrías que componen el parche y el ground plane.

Model

Solids

air

Box1

Rogers RT/duroid 5880 (tm)

Substrate

CreateBox

Sheets

Lumped Port

Perfect E

GND

Patch

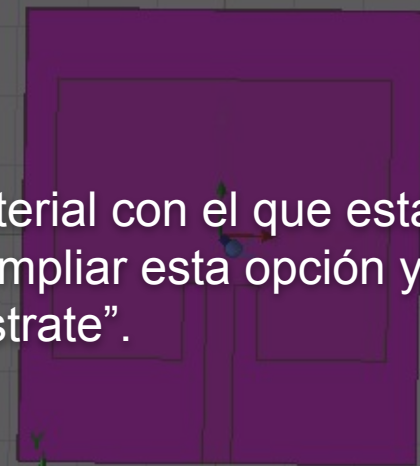
Coordinate Systems

Planes

Lists

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2023 R2
STUDENT

Para cambiar el material con el que está hecho el sustrato, ampliar esta opción y hacer doble click en "Substrate".




0 30 60 (mm)

Properties: Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler



Attribute

	Name	Value	Unit	Evaluated Value	Description	Read-only
	Name	Substrate				<input type="checkbox"/>
	Material	"Rogers RT/duroid 5880 (tm)"		"Rogers RT/du..."		<input type="checkbox"/>
	Solve Inside	Edit...				<input type="checkbox"/>
	Orientation	"Rogers RO3003 (tm)"				<input type="checkbox"/>
	Model	"Rogers RT/duroid 5880 (tm)"				<input type="checkbox"/>
	Group	"air"				<input type="checkbox"/>
	Display Wirefra...	<input type="checkbox"/>				<input type="checkbox"/>
	Material Appea...	<input type="checkbox"/>				<input type="checkbox"/>
	Color					<input type="checkbox"/>
	Transparent	0				<input type="checkbox"/>

☐ Show Hidden

Aceptar

Cancelar

Aplicar

Select Definition



Materials

Material Filters

Search Parameters

Search by Name

FR4_epoxy

Search

Search Criteria

☒ by Name☐ by Property

Relative Permittivity

Libraries

☒ Show Project definitions☐ Select all libraries

[sys] Materials

	Name	Location	Origin	Relative Permittivity	Relative Permeability	Bulk Conductivity
	FR4_epoxy	SysLibrary	Materials	4.4	1	0
	gallium_arsenide	SysLibrary	Materials	12.9	1	0
	GE GETEK ML200/RG200 (tm)	SysLibrary	Materials	3.9	1	0
	GIL GML1000 (tm)	SysLibrary	Materials	3.12	1	0
	GIL GML1032 (tm)	SysLibrary	Materials	3.2	1	0
	GIL GML2032 (tm)	SysLibrary	Materials	3.2	1	0
	GIL MC5 (tm)	SysLibrary	Materials	3.2	1	0
	glass	SysLibrary	Materials	5.5	1	0
	glass_PTFEreinf	SysLibrary	Materials	2.5	1	0
	gold	SysLibrary	Materials	1	0.99996	41000000
	graphite	SysLibrary	Materials	1	1	70000
	HDPE plastic	SysLibrary	Materials	2.3	1	0
	HierV R1755V	SysLibrary	Materials	4.4	1	0

View/Edit Materials...

Add Material...

Clone Material(s)

Remove Material(s)

Export to Library...

Aceptar

Cancelar

Ayuda

Select Definition



Materials | Material Filters

Search Parameters

Search by Name

FR4_epoxy

Search

Search Criteria

☒ by Name☐ by Property

Relative Permittivity

Libraries

☒ Show Project definitions☐ Select all libraries

[sys] Materials

	Name	Location	Origin	Relative Permittivity	Relative Permeability	Bulk Conductivity
	FR4_epoxy	SysLibrary	Materials	4.4	1	0
	gallium_arsenide	SysLibrary	Materials	12.9	1	0
	GE GETEK ML200/RG200 (tm)	SysLibrary	Materials	3.9	1	0
	GIL GML1000 (tm)	SysLibrary	Materials	3.12	1	0
	GIL GML1032 (tm)	SysLibrary	Materials	3.2	1	0
	GIL GML2032 (tm)	SysLibrary	Materials	3.2	1	0
	GIL MC5 (tm)	SysLibrary	Materials	3.2	1	0
	glass	SysLibrary	Materials	1	1	0
	glass_PTFEreinf	SysLibrary	Materials	2.5	1	0
	gold	SysLibrary	Materials	1	0.99996	41000000
	graphite	SysLibrary	Materials	1	1	70000
	HDPE plastic	SysLibrary	Materials	2.3	1	0
	HierV R1755V	SysLibrary	Materials	4.4	1	0

Si, por ejemplo, se quiere crear un material ya existente pero con algún parámetro distinto, se selecciona esta opción.

View/Edit Materials...

Add Material...

Clone Material(s)

Remove Material(s)

Export to Library...

Aceptar

Cancelar

Ayuda

Select Definition

View / Edit Material

Materials | Material Fil

Search Parameters
Search by Name

FR4_epoxy

Search

FR4_epoxy

gallium_arsenid

GE GETEK ML

GIL GML1000 (

GIL GML1032 (

GIL GML2032 (

GIL MC5 (tm)

glass

glass_PTFErein

gold

graphite

HDPE plastic

HiperV R1755



View/Edit Material

Material Name

FR4_epoxy - Copy

Properties of the Material

	Name	Type	Value	Units
	Relative Permittivity	Simple	4.4	
	Relative Permeability	Simple	1	
	Bulk Conductivity	Simple	0	siemens/m
	Dielectric Loss Tangent	Simple	0.02	
	Magnetic Loss Tangent	Simple	0	
	Magnetic Saturation	Simple	0	tesla
	Lande G Factor	Simple	2	
	Delta H	Simple	0	A_per_meter
	- Measured Frequency	Simple	9.4e+09	Hz
	Mass Density	Simple	1900	kg/m^3

Notes

Set Frequency Dependency...

Calculate Properties for:

Reset

OK

Cancel

View/Edit Material for

☒ Active Design☐ Active Project☐ All Properties

Physics:

☒ Electromagnetic☒ Thermal☒ Structural

View/Edit Modifier for

☐ Thermal Modifier☐ Spatial Modifier

Material Appearance

☒ Use Material Appearance

Color:



Transparency:

0

Validate Material

Desktop View Draw Model **Simulation** Results Automation Ansys Minerva Learning and Support

Project Manager

- Inset-fed microstrip patch antenna parametrizada
 - HFSSDesign1 (Terminal Network)
 - 3D Components
 - Model
 - Circuit Elements
 - Boundaries
 - Excitations
 - Mesh
 - Analysis**
 - Setup1
 - Sweep
 - Optimetrics
 - Results
 - Port Field Display
 - Field Overlays
 - Radiation
 - Definitions

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler

Model

- Solids
 - air
 - Box1
 - Rogers RT/duroid 5880 (tm)
 - Substrate
 - CreateBox
- Sheets
 - Lumped Port
 - Perfect E
 - Patch
- Coordinate Systems
- Planes
- Lists

Expanding this option, you can observe the frequency sweep used. If you click on "sweep", you can see...

Variables

Name	Value	Unit	Evaluated Value
\$f	2.45	GHz	2.45GHz
\$epsilon_r	2.2		2.2
\$h	1.5	mm	1.5mm
\$Wp	48.4	mm	48.4mm
\$Lp	40.5	mm	40.5mm
\$Wg	$Wp + 6 \cdot h$		57.4mm
\$Lg	$Lp + Lf + z$		65.5mm
\$Wf	4.1	mm	4.1mm
\$g	3.321	mm	3.321mm
\$d	10.92	mm	10.92mm
\$Lf	15	mm	15mm
\$z	10	mm	10mm
Project var...	Add...		

Project Design

Progress

Ready

Show 0 Messages Hide Progress

Edit Frequency Sweep



General Defaults

Sweep Name:

Sweep

☒ Enabled

Sweep Type:

Fast

Frequency Sweeps [151 points defined]

	Distribution	Start	End		
1	Linear Step	1.5GHz	3GHz	Step size	0.01GHz

Add Above

Add Below

Delete Selection

Preview ...

3D Fields Save Options

☒ Save Fields

☐ Save radiated fields only

☐ Generate fields at solve time
(All Frequencies)

Time Domain Calculation...

S Matrix Only Solve

☒ Auto

☐ Manual - Allow for frequencies above

1

MHz

Aceptar

Cancelar

Save Cut Undo Copy Redo Paste Delete Mesh Settings Feedback Setup Sweep Optimetrics Validate Analyze All HPC Options Scheduler Submit Monitor

Desktop View Draw Model Simulation Results Automation Ansys Minerva Learning and Support

Project Manager

Inset-fed microstrip patch antenna parametrizada

- HFSSDesign1 (Terminal Network)
 - 3D Components
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Variables

Name	Value	Unit	Evaluated Value
\$f	2.45	GHz	2.45GHz
\$epalson_r	2.2		2.2
\$h	1.5	mm	1.5mm
\$Wp	48.4	mm	48.4mm
\$Lp	40.5	mm	40.5mm
\$Wg	$Wp + 6 \cdot h$		57.4mm
\$Lg	$Lp + Lf + z$		65.5mm
\$Wf	4.1	mm	4.1mm
\$g	3.321	mm	3.321mm
\$d	10.92	mm	10.92mm
\$Lf	15	mm	15mm
\$z	10	mm	10mm
Project var...	Add...		

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler

Model

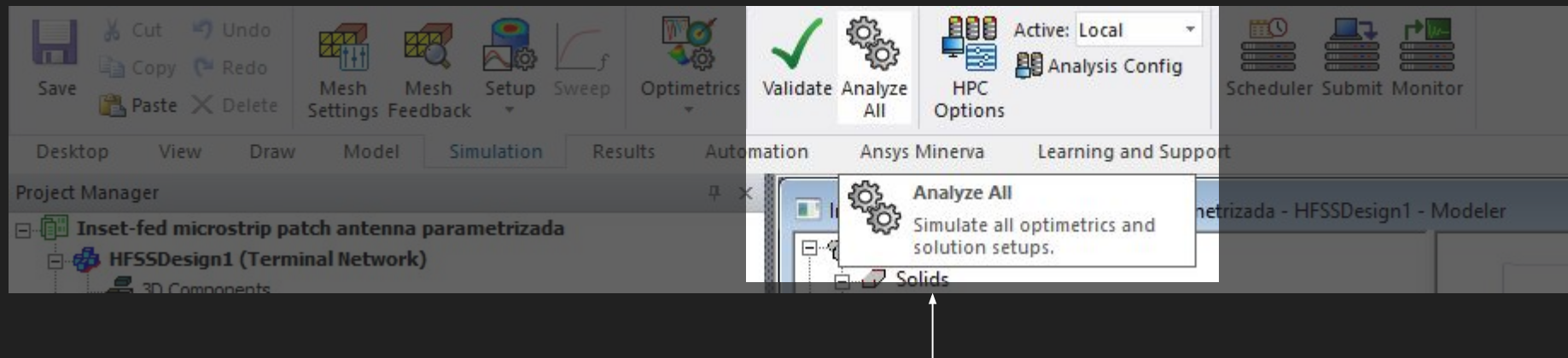
- Solids
 - air
 - Box1
 - Rogers RT/duroid 5880 (tm)
 - Substrate
 - Box
- Sheets
 - GND
 - Patch
- Coordinate Systems
- Planes
- Lists

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Progress

Ready Show 0 Messages Hide Progress

Clickeando la ventana "Simulations", se pueden observar todas las opciones de simulación.



Para realizar la simulación electromagnética de la antena, clicar donde dice “Analyze All”.

Desktop View Draw Model Simulation Results Automation Ansys Minerva Learning and Support

Project Manager

Inset-fed microstrip patch antenna parametrizada*

- HFSSDesign1 (Terminal Network)*
 - 3D Components
 - Model
 - Circuit Elements
 - Boundaries
 - Excitations
 - Mesh
 - Analysis
 - Setup1
 - Sweep
 - Optimetrics
 - Results
 - Port Field Display
 - Field Overlays
 - Radiation
 - Definitions

Variables

Name	Value
Sf	2.45 GHz 2.45GHz
Sepsilon_r	2.2
Sh	1.5 mm 1.5mm
\$Wp	48.4 mm 48.4mm
\$Lp	40.5 mm 40.5mm
\$Wg	$Wp + 6 \cdot Sh$ 57.4mm
\$Lg	$Lp + Lf + Sz$ 65.5mm
\$Wf	4.1 mm 4.1mm
\$g	3.321 mm 3.321mm
\$d	10.92 mm 10.92mm
\$Lf	15 mm 15mm
\$z	10 mm 10mm
Project var...	Add...

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Modeler

- Model
 - Solids
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 - Lists

Una barra de carga va a aparecer señalando el progreso de la simulación. Cuando la barra desaparezca, la simulación habrá terminado.

Progress

Inset-fed microstrip patch antenna parametrizada - HFSSDesign1 - Setup1: Adaptive meshing process completed... on Local Machine - RUNNING

Show 2 Messages Hide Progress

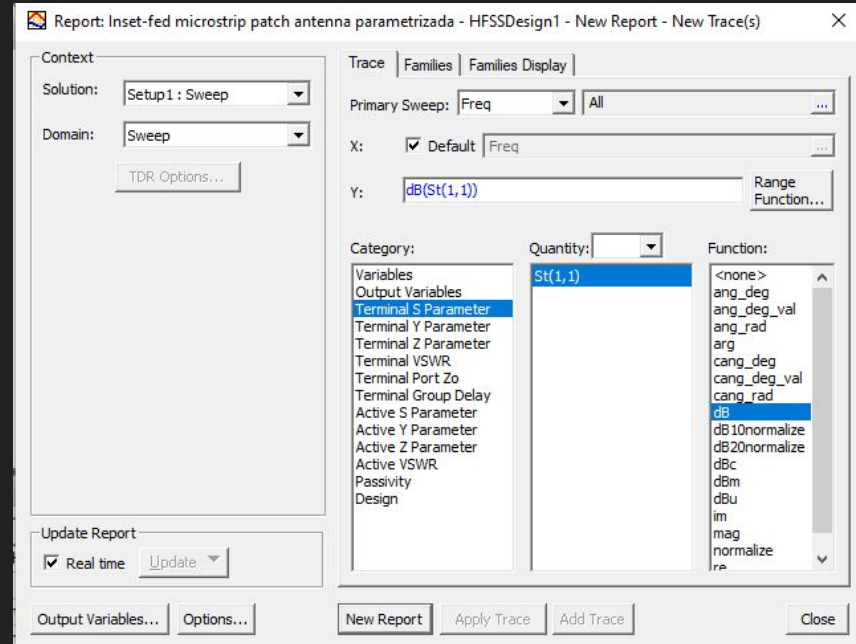
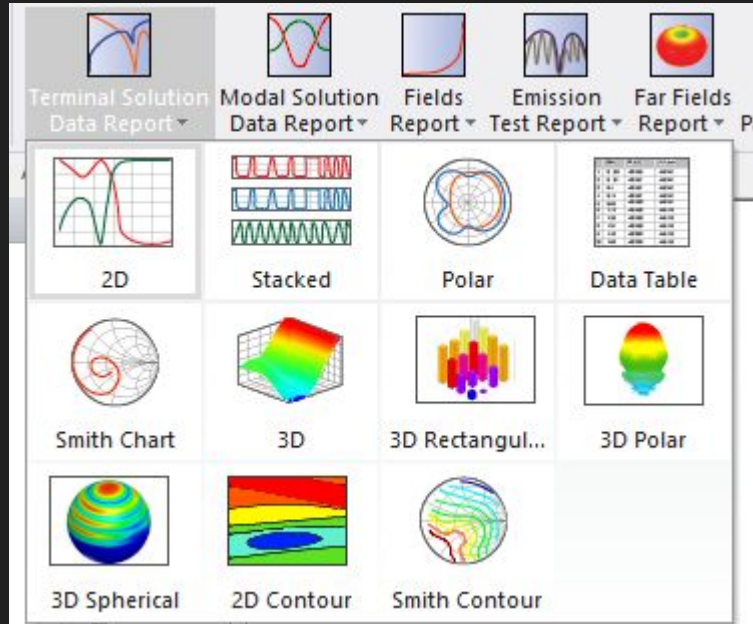
Una vez terminada la solución, se deberá ir a la pestaña de “Results”.

Variables

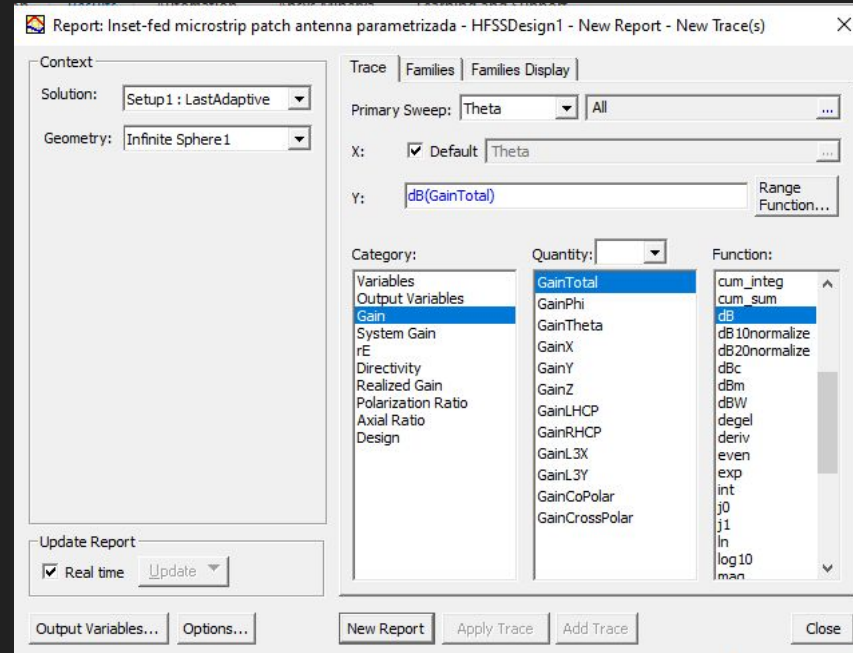
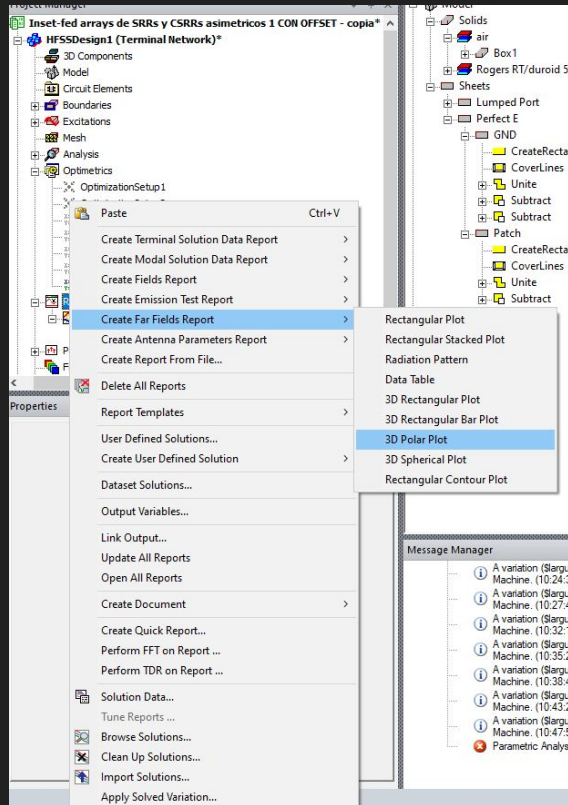
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\$Wp	48.4	mm	48.4mm
\$Lp	40.5	mm	40.5mm
\$Wg	$Wp + 6 \cdot Sh$		57.4mm
\$Lg	$Lp + Lf + Sz$		65.5mm
\$Wf	4.1	mm	4.1mm
\$g	3.321	mm	3.321mm
\$d	10.92	mm	10.92mm
\$Lf	15	mm	15mm
\$z	10	mm	10mm
Project var...	Add...		

Project Design

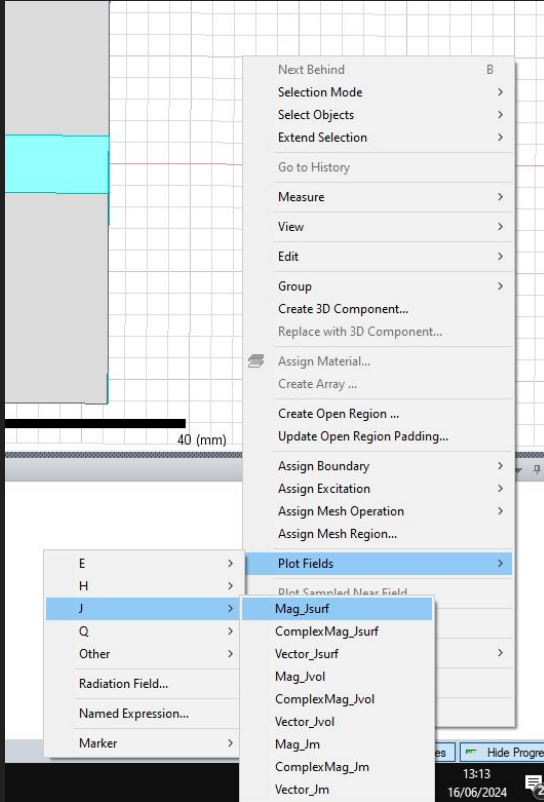
Para graficar el S11:



Para graficar el patrón de radiación:



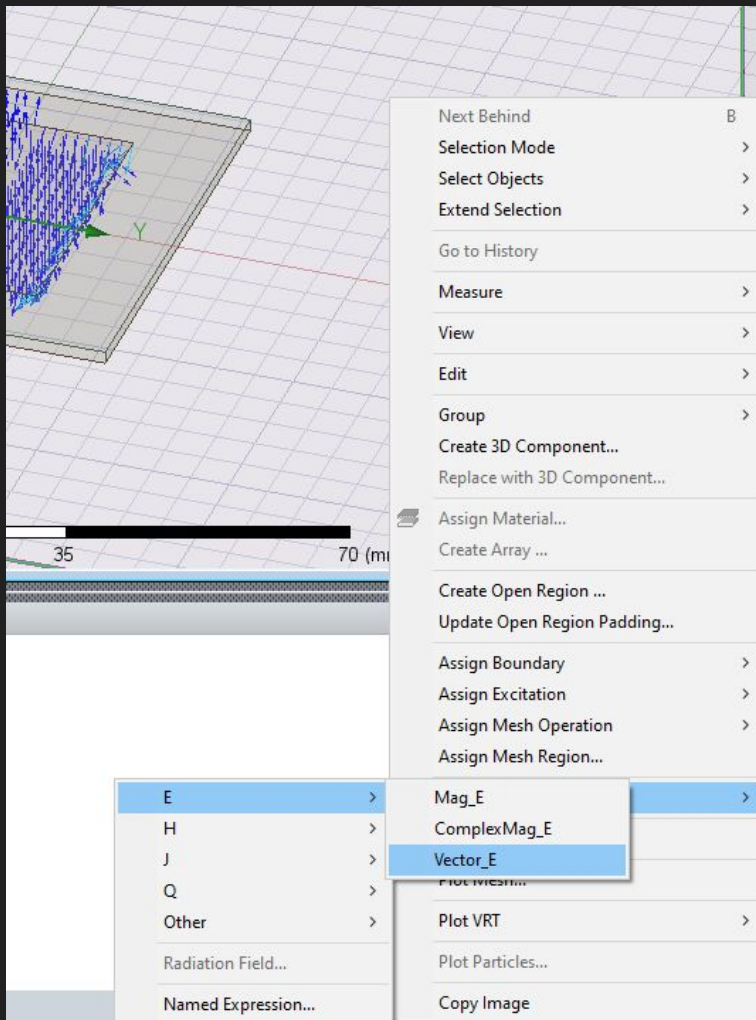
Para graficar densidad de corriente:



Si queremos la densidad de corriente en el patch, debemos seleccionar el patch previamente.

Mag_Jsurf : módulo del vector densidad de corriente superficial (campo escalar).

Vector_Jsurf : vector densidad de corriente superficial (campo vectorial).



Igualmente para el campo eléctrico:

Vector_Esurf : vector campo eléctrico
(campo vectorial).

Para animar un resultado:

