

電工實驗 5

第五次實驗

低通濾波器設計

預報

Date: 2024/10/15

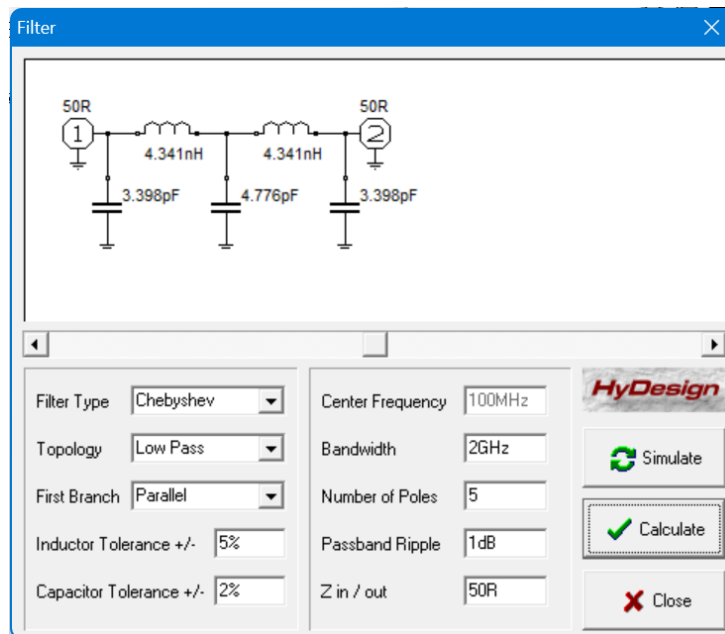
Class: 電機四全英班

Group: Group 9

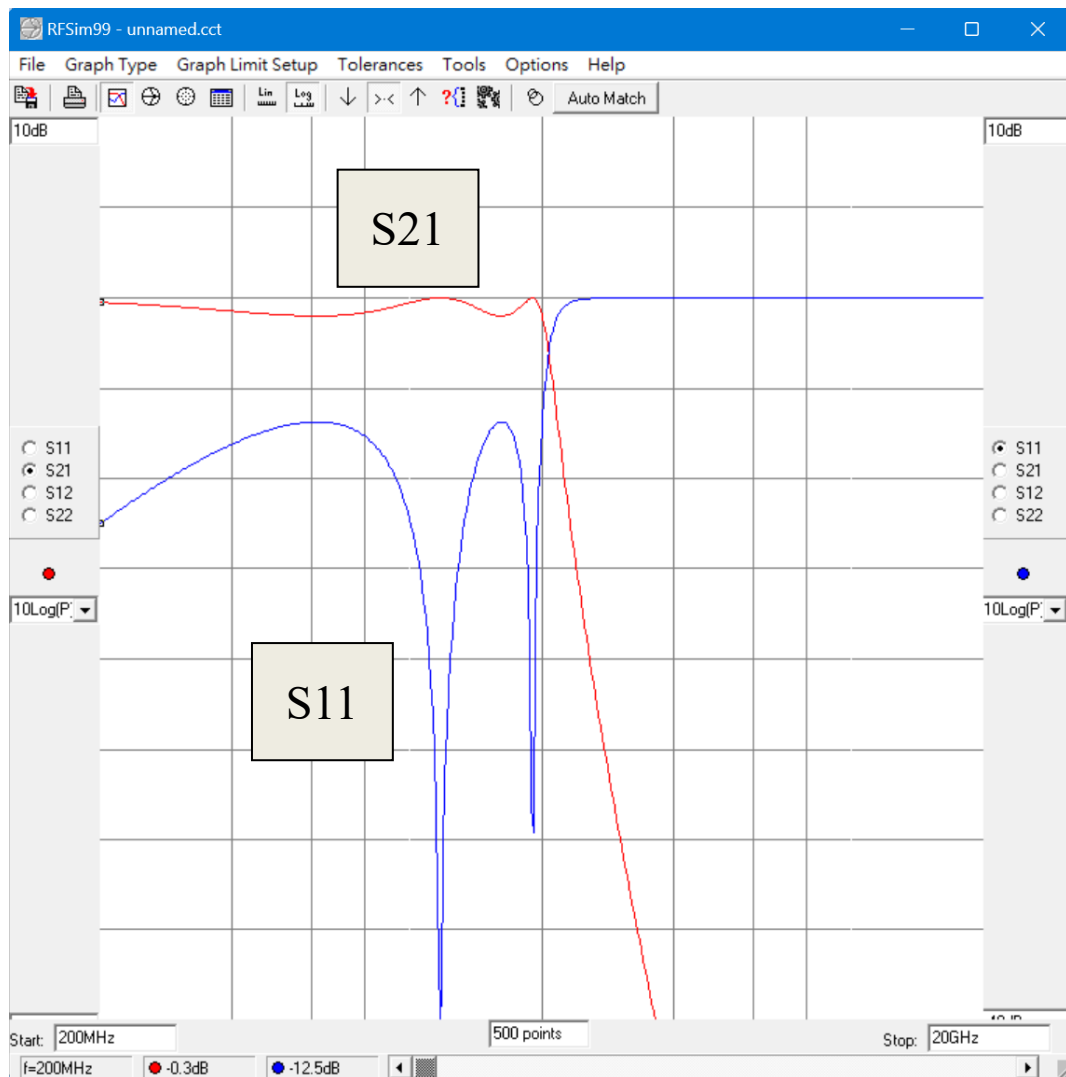
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I. RFSim99 設定



S11, S21 波形圖



II. TXLine 設定

微帶線特徵阻抗:

A. 123 Ω

The screenshot shows the TXLINE 2003 - Microstrip software interface. The 'Material Parameters' section is set to Dielectric: GaAs, Conductor: Copper, Dielectric Constant: 4.7, Conductivity: 5.88E+07 S/m, and Loss Tangent: 0.02. The 'Electrical Characteristics' section shows Impedance: 123 Ohms, Frequency: 2 GHz, Electrical Length: 45 deg, Phase Constant: 4221.4 deg/m, Effective Diel. Const.: 3.08952, and Loss: 7.61198 dB/m. The 'Physical Characteristic' section shows Physical Length (L): 10.66 mm, Width (W): 0.158458 mm, Height (H): 0.8 mm, and Thickness (T): 0.01 mm. A diagram on the right shows a cross-section of a microstrip line with width W, height H, and thickness T.

Material Parameters	Electrical Characteristics	Physical Characteristic
Dielectric: GaAs	Impedance: 123 Ohms	Physical Length (L): 10.66 mm
Conductor: Copper	Frequency: 2 GHz	Width (W): 0.158458 mm
Dielectric Constant: 4.7	Electrical Length: 45 deg	Height (H): 0.8 mm
Conductivity: 5.88E+07 S/m	Phase Constant: 4221.4 deg/m	Thickness (T): 0.01 mm
Loss Tangent: 0.02	Effective Diel. Const.: 3.08952	
	Loss: 7.61198 dB/m	

特性阻抗設為 123 Ω ,得到線長為 10.66mm,線寬為 0.158458mm。

B. 83 Ω

The screenshot shows the TXLINE 2003 - Microstrip software interface. The 'Material Parameters' section is set to Dielectric: GaAs, Conductor: Copper, Dielectric Constant: 4.7, Conductivity: 5.88E+07 S/m, and Loss Tangent: 0.02. The 'Electrical Characteristics' section shows Impedance: 83 Ohms, Frequency: 2 GHz, Electrical Length: 45 deg, Phase Constant: 4336.06 deg/m, Effective Diel. Const.: 3.25962, and Loss: 6.99216 dB/m. The 'Physical Characteristic' section shows Physical Length (L): 10.3781 mm, Width (W): 0.517887 mm, Height (H): 0.8 mm, and Thickness (T): 0.01 mm. A diagram on the right shows a cross-section of a microstrip line with width W, height H, and thickness T.

Material Parameters	Electrical Characteristics	Physical Characteristic
Dielectric: GaAs	Impedance: 83 Ohms	Physical Length (L): 10.3781 mm
Conductor: Copper	Frequency: 2 GHz	Width (W): 0.517887 mm
Dielectric Constant: 4.7	Electrical Length: 45 deg	Height (H): 0.8 mm
Conductivity: 5.88E+07 S/m	Phase Constant: 4336.06 deg/m	Thickness (T): 0.01 mm
Loss Tangent: 0.02	Effective Diel. Const.: 3.25962	
	Loss: 6.99216 dB/m	

特性阻抗設為 83 Ω ,得到線長為 10.3781mm,線寬為 0.517887mm。

C. 21Ω

The screenshot shows the TXLINE 2003 - Microstrip software interface. The 'Material Parameters' section is set to Dielectric: GaAs, Dielectric Constant: 4.7, Loss Tangent: 0.02, Conductor: Copper, and Conductivity: $5.88\text{E}+07$ S/m. The 'Electrical Characteristics' section shows Impedance: 21 Ohms, Frequency: 2 GHz, Electrical Length: 45 deg, Phase Constant: 4793.6 deg/m, Effective Diel. Const.: 3.98382, and Loss: 7.62958 dB/m. The 'Physical Characteristic' section shows Physical Length (L): 9.38752 mm, Width (W): 5.01905 mm, Height (H): 0.8 mm, and Thickness (T): 0.01 mm. A diagram on the right illustrates the microstrip geometry with parameters W, H, ϵ_r , and T.

Material Parameters	
Dielectric	GaAs
Dielectric Constant	4.7
Loss Tangent	0.02
Conductor	Copper
Conductivity	$5.88\text{E}+07$ S/m

Electrical Characteristics	
Impedance	21 Ohms
Frequency	2 GHz
Electrical Length	45 deg
Phase Constant	4793.6 deg/m
Effective Diel. Const.	3.98382
Loss	7.62958 dB/m

Physical Characteristic	
Physical Length (L)	9.38752 mm
Width (W)	5.01905 mm
Height (H)	0.8 mm
Thickness (T)	0.01 mm

特性阻抗設為 21Ω , 得到線長為 9.38752mm, 線寬為 5.01905mm。

D. 71Ω

The screenshot shows the TXLINE 2003 - Microstrip software interface. The 'Material Parameters' section is set to Dielectric: GaAs, Dielectric Constant: 4.7, Loss Tangent: 0.02, Conductor: Copper, and Conductivity: $5.88\text{E}+07$ S/m. The 'Electrical Characteristics' section shows Impedance: 71 Ohms, Frequency: 2 GHz, Electrical Length: 45 deg, Phase Constant: 4387.18 deg/m, Effective Diel. Const.: 3.33693, and Loss: 6.96824 dB/m. The 'Physical Characteristic' section shows Physical Length (L): 10.2572 mm, Width (W): 0.741359 mm, Height (H): 0.8 mm, and Thickness (T): 0.01 mm. A diagram on the right illustrates the microstrip geometry with parameters W, H, ϵ_r , and T.

Material Parameters	
Dielectric	GaAs
Dielectric Constant	4.7
Loss Tangent	0.02
Conductor	Copper
Conductivity	$5.88\text{E}+07$ S/m

Electrical Characteristics	
Impedance	71 Ohms
Frequency	2 GHz
Electrical Length	45 deg
Phase Constant	4387.18 deg/m
Effective Diel. Const.	3.33693
Loss	6.96824 dB/m

Physical Characteristic	
Physical Length (L)	10.2572 mm
Width (W)	0.741359 mm
Height (H)	0.8 mm
Thickness (T)	0.01 mm

特性阻抗設為 71Ω , 得到線長為 10.2572mm, 線寬為 0.741359mm。

E. 17Ω

TXLINE 2003 - Microstrip

Microstrip | Stripline | CPW | CPW Ground | Round Coaxial | Slotline | Coupled MSLine | Coupled Stripline

Material Parameters

Dielectric: GaAs | Conductor: Copper

Dielectric Constant: 4.7 | Conductivity: 5.88E+07 S/m

Loss Tangent: 0.02

Electrical Characteristics

Impedance: 17 Ohms

Frequency: 2 GHz

Electrical Length: 45 deg

Phase Constant: 4852.64 deg/m

Effective Diel. Const.: 4.08255

Loss: 7.75967 dB/m

Physical Characteristic

Physical Length (L): 9.27331 mm

Width (W): 6.5159 mm

Height (H): 0.8 mm

Thickness (T): 0.01 mm

特性阻抗設為 17Ω , 得到線長為 9.27331mm, 線寬為 6.5159mm。

III. Libra 的 code

```
DIM
FREQ GHZ
RES OH
LNG MM
ANG DEG
IND NH
CAP PF

CKT
MSUB ER=4.7 H=0.8 T=0.01 RHO=0 RGH=0
TAND TAND=0.02
MLIN 1 2 W=0.158458 L=10.66
MLIN 1 3 W=0.517887 L=10.3781
MLIN 3 4 W=5.01905 L=9.38752
MLIN 3 5 W=0.741359 L=10.2572
MLIN 5 6 W=6.5159 L=9.27331
MLIN 5 7 W=0.741359 L=10.2572
MLIN 7 8 W=5.01905 L=9.38752
MLIN 7 9 W=0.517887 L=10.3781
MLIN 9 10 W=0.158458 L=10.66
DEF2P 1 9 EXP1

FREQ
SWEEP 0 4.5 0.01

OUT
EXP1 DB[S21] GR1

GRID
RANGE 0 4.5 0.01
GR1 -50 0 1
```

IV. 模擬結果

