$$Y = i \omega C_0 + 2 w^2 Y_{11}^2 d_{31}^2 igg(rac{1}{D}igg)$$

其中分母 D 是复数:

$$D = a + ib$$

其中

$$a=Z_0rac{Al}{2}+R_{l/2}$$
  $b=rac{\pi Z_0\Delta f_n}{2f_{n(\mathrm{air})}}+X_{l/2}$   $|D|=\sqrt{a^2+b^2}$   $rac{d|D|}{d(\Delta f_n)}=rac{d}{d(\Delta f_n)}\Big(\sqrt{a^2+b^2}\Big)$ 

首先求b对 $\Delta f_n$ 的导数:

$$egin{align} b &= rac{\pi Z_0 \Delta f_n}{2 f_{n( ext{air})}} + X_{l/2} \ & rac{db}{d(\Delta f_n)} &= rac{\pi Z_0}{2 f_{n( ext{air})}} \end{split}$$

使用链式法则:

$$egin{aligned} rac{d|D|}{d(\Delta f_n)} &= rac{1}{2\sqrt{a^2+b^2}} \cdot 2b \cdot rac{db}{d(\Delta f_n)} \ & rac{d|D|}{d(\Delta f_n)} &= rac{b}{\sqrt{a^2+b^2}} \cdot rac{\pi Z_0}{2f_{n( ext{air})}} \end{aligned}$$

设置导数为零以找到极值:

$$rac{b}{\sqrt{a^2+b^2}}\cdotrac{\pi Z_0}{2f_{n(\mathrm{air})}}=0$$

由于  $\frac{\pi Z_0}{2f_{n(\text{air})}} \neq 0$ ,我们必须有:

$$b = 0$$

约束条件

我们知道:

$$b=rac{\pi Z_0 \Delta f_n}{2 f_{n(\mathrm{air})}} + X_{l/2}$$

将 b 设为零:

$$rac{\pi Z_0 \Delta f_n}{2 f_{n(\mathrm{air})}} + X_{l/2} = 0$$

解这个方程,得到:

$$rac{\Delta f_n}{f_{n( ext{air})}} = rac{-2X_{l/2}}{\pi Z_0}$$