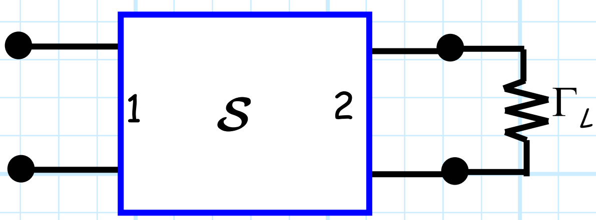
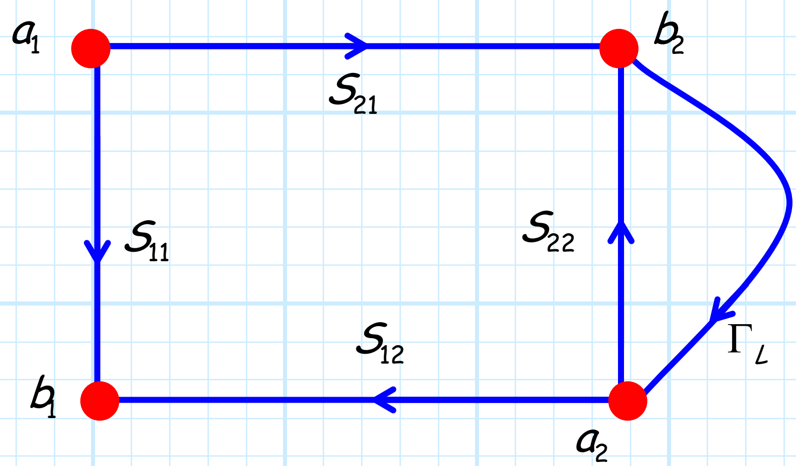
Example: Decomposition of Signal Flow Graphs

Consider the basic 2-port network, terminated with load Γ_L.





Say we want to determine the value:

$$\Gamma_1 \doteq \frac{V_1^-(z=z_{1P})}{V_1^+(z=z_{1P})} = \frac{b_1}{a_1} \quad ??$$

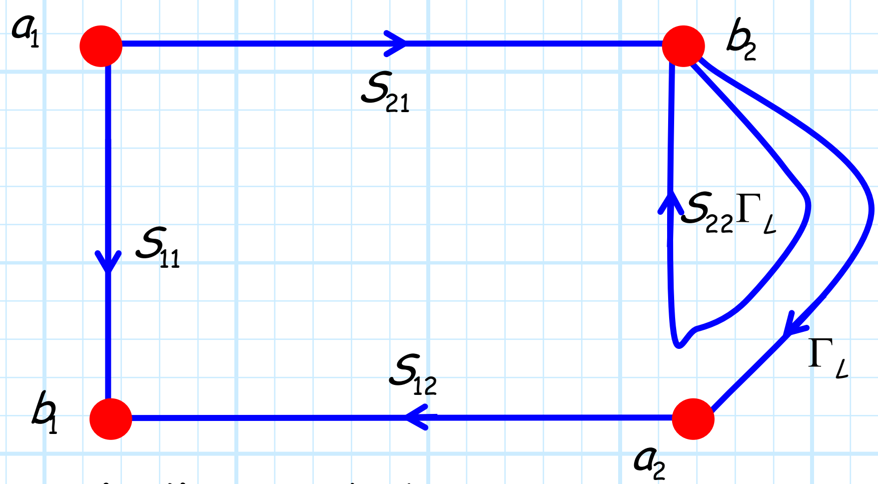
In other words, what is the **reflection coefficient** of the resulting **one-port** device?

Q: *Isn't this simply S_{11} ?*

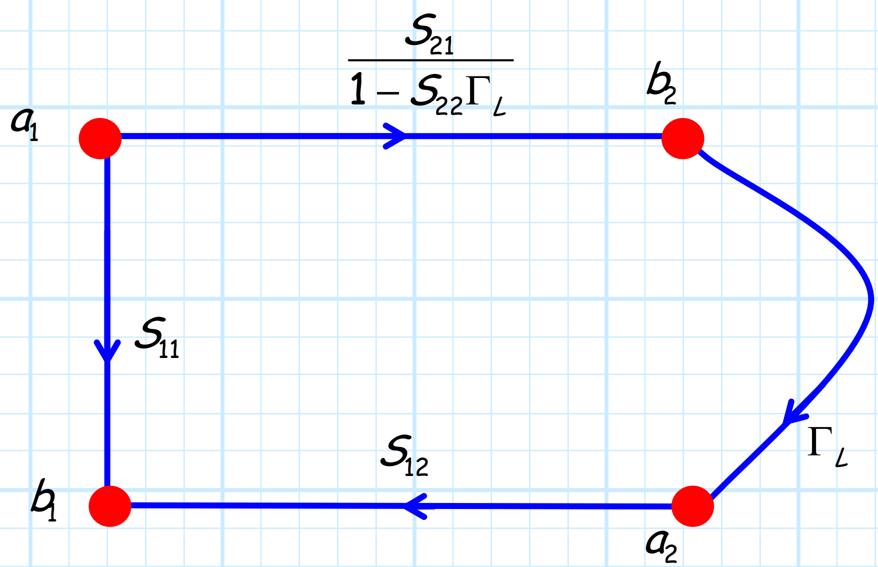
A: **Only** if $\Gamma_L = 0$ (and it's **not**)!!

So let's decompose (simplify) the signal flow graph and find out!

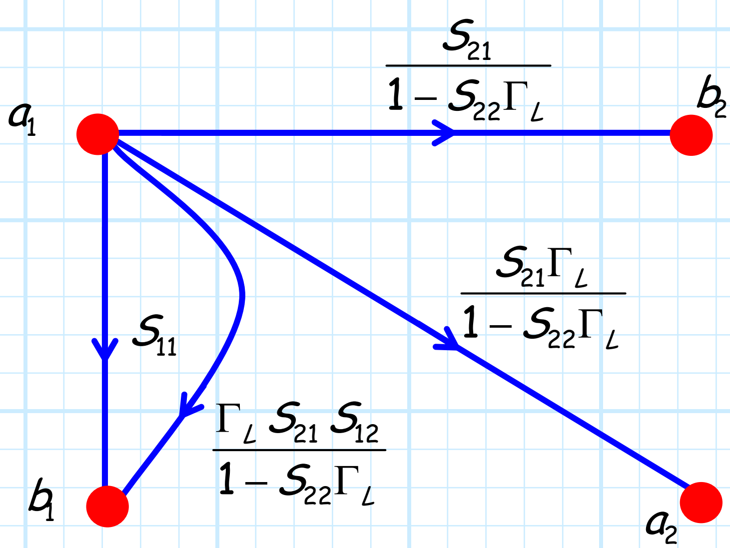
Step 1: Use **rule #4** on node a_2



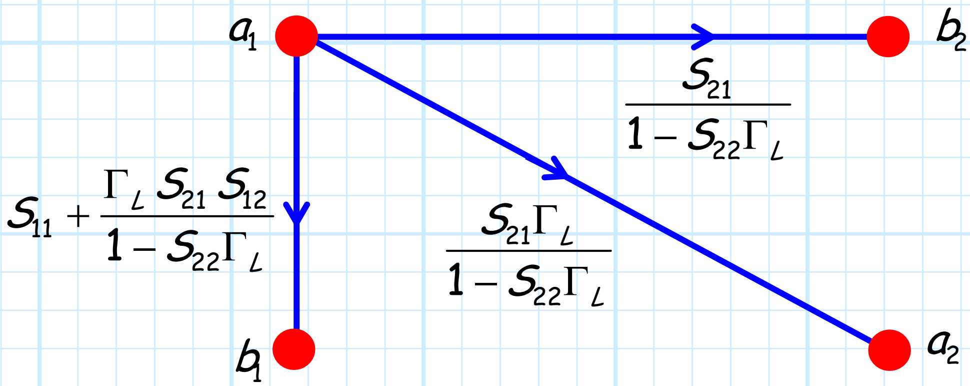
Step 2: Use **rule #3** on node b_2



Step 3: And then using **rule #1**:



Step 4: Use **rule 2** on nodes a_1 and b_1



Therefore:

$$\Gamma_1=\frac{b_1}{a_1}=S_{11}+\frac{\Gamma_L S_{21} S_{12}}{1-S_{22}\Gamma_L}$$

Note if $\Gamma_L=0$, then $b_1/a_1=S_{11}$!