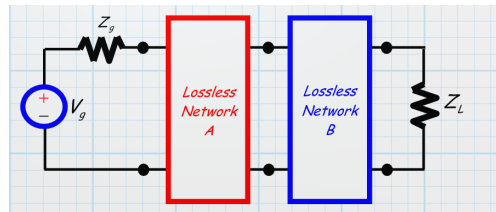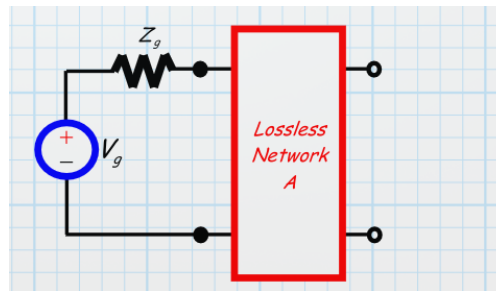# EECS 622: Homework #5

September 15, 2025

Grant Saggars

Two lossless networks have been inserted between an unknown source and a load. The networks have been designed such that all the available power from the source is delivered to the load!!!!!
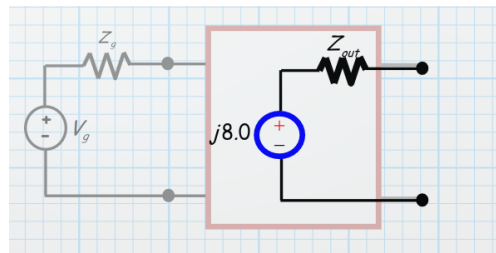
1. Say we cut the circuit into two pieces, right where the two lossless networks connect to each other.
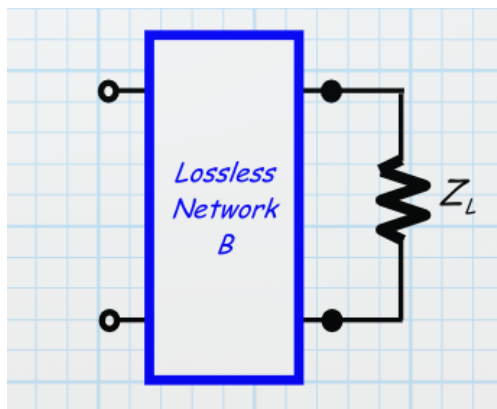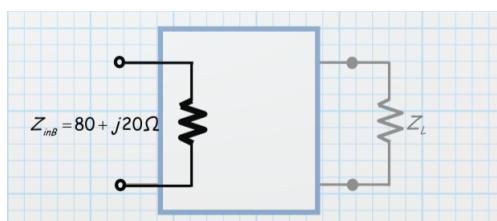

The left side is thus a source:

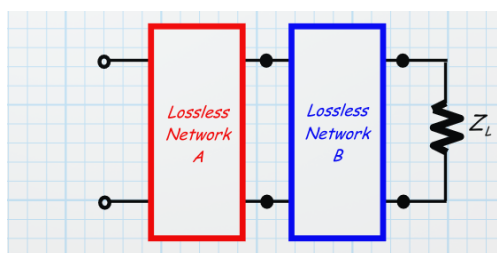We find that the Thevenin's equivalent of this source has $V_{\text{out}} = j8.0$:

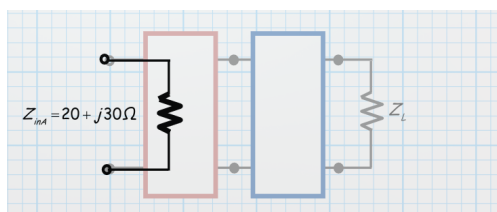The right side of the circuit is therefore a load:

We find that this load has an input impedance $Z_{\text{ins}} = 80 + j20\Omega$:

2. Now, say we instead split the circuit in a different place, between the source and the first lossless network. The circuit to the right is now a load:

We find that this load has an input impedance $Z_{\text{ind}} = 20 + j30\Omega$:

Determine (providing explicit rationale):

A The source impedance Z_g.

> **Solution:**
>
> We may exploit the fact that this is both lossless and matched somewhere in the network (as all available power is delivered) to conclude that
>
> $$Z_g = Z_{inA}^* = 20 - j30 \ \Omega$$

B The magnitude(!) of the source voltage V_g.

> **Solution:**
>
> Because this is a lossless network,
> $$P_g^{avl} = P_L^{avl}$$
>
> Further, because this is matched, all available power is absorbed, such that the right hand side becomes:
> $$P_g^{avl} = P_L^{abs}$$
>
> Now, the issue comes with determining load impedance.
>
> $$\begin{aligned}
> P_g^{avl} &= P_{out}^{avl} \\
> \frac{|V_g|^2}{8R_g} &= \frac{|V_{out}|^2}{8R_{out}} \qquad &\text{(Substitute known equations)} \\
> \frac{|V_g|^2}{8R_g} &= \frac{|V_{out}|^2}{8R_{inB}} \qquad &\text{(Matched; } R_{out} = R_{inB}) \\
> |V_g| &= |V_{out}|\sqrt{\frac{R_g}{R_{inB}}} \\
> |V_g| &= 8\sqrt{\frac{1}{4}} = 4 \text{ V}
> \end{aligned}$$