C. Microwave Sources

Q: *A passive load Z_L specifies $Z(z)$ and $\Gamma(z)$, but we still don't explicitly know $V(z), I(z)$ or $V^+(z), V^-(z)$. How are these functions determined?*

A: All of these quantities are zero, unless a source (generator) is applied to trans. line. The **boundary condition** enforced by the generator will then **explicitly** determine these functions!

HO: A Transmission Line Connecting Source and Load

Q: *OK, we can **finally** ask the question that we have been concerned with since the very beginning: How much **power** is delivered **to** the load **by** the source?*

A: *HO: Delivered Power*

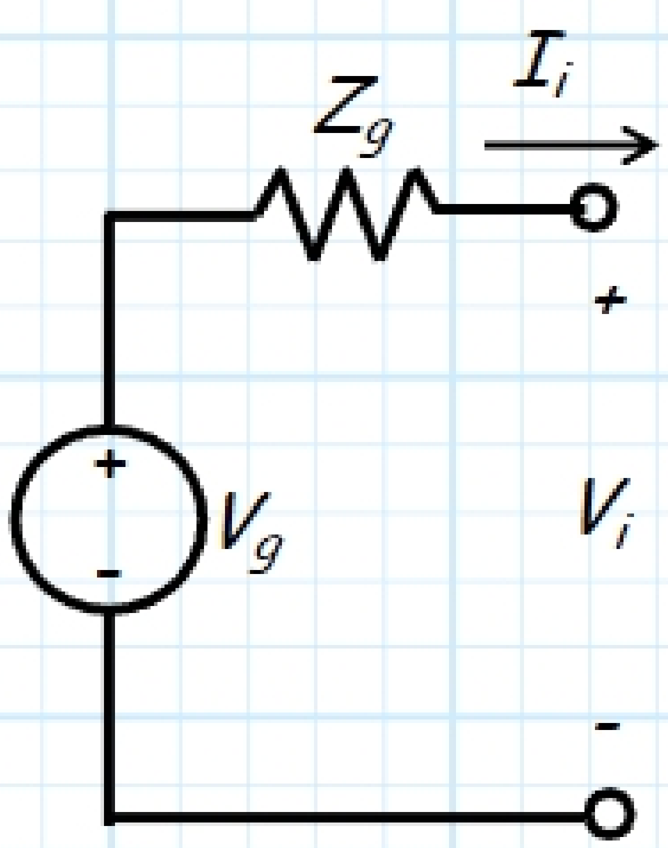
Q: *So the power transferred depends on the **source**, the **transmission line**, and the **load**. What combination of these devices will result in **maximum** power transfer?*

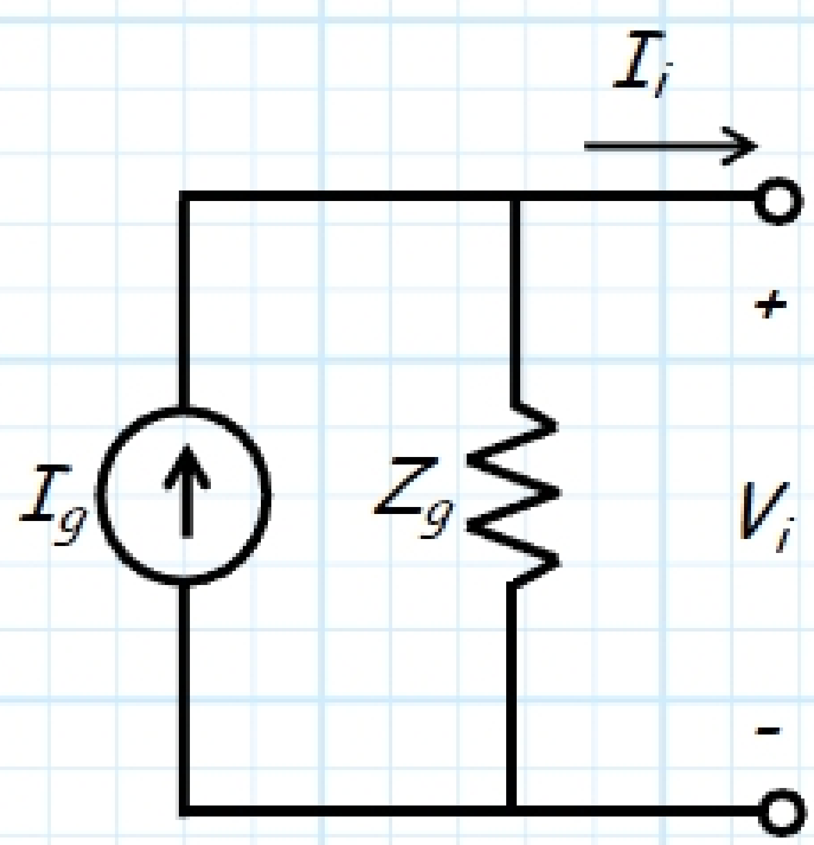
A: *HO: Special Cases of Source and Input Impedances*

A Transmission Line Connecting Source & Load

We can think of a transmission line as a conduit that allows **power** to flow **from** an **output** of one device/network **to** an **input** of another.

To simplify our analysis, we can model the **input** of the device **receiving** the power with it input impedance (e.g., Z_L), while we can model the device **output delivering** the power with its Thevenin's or Norton's equivalent circuit.

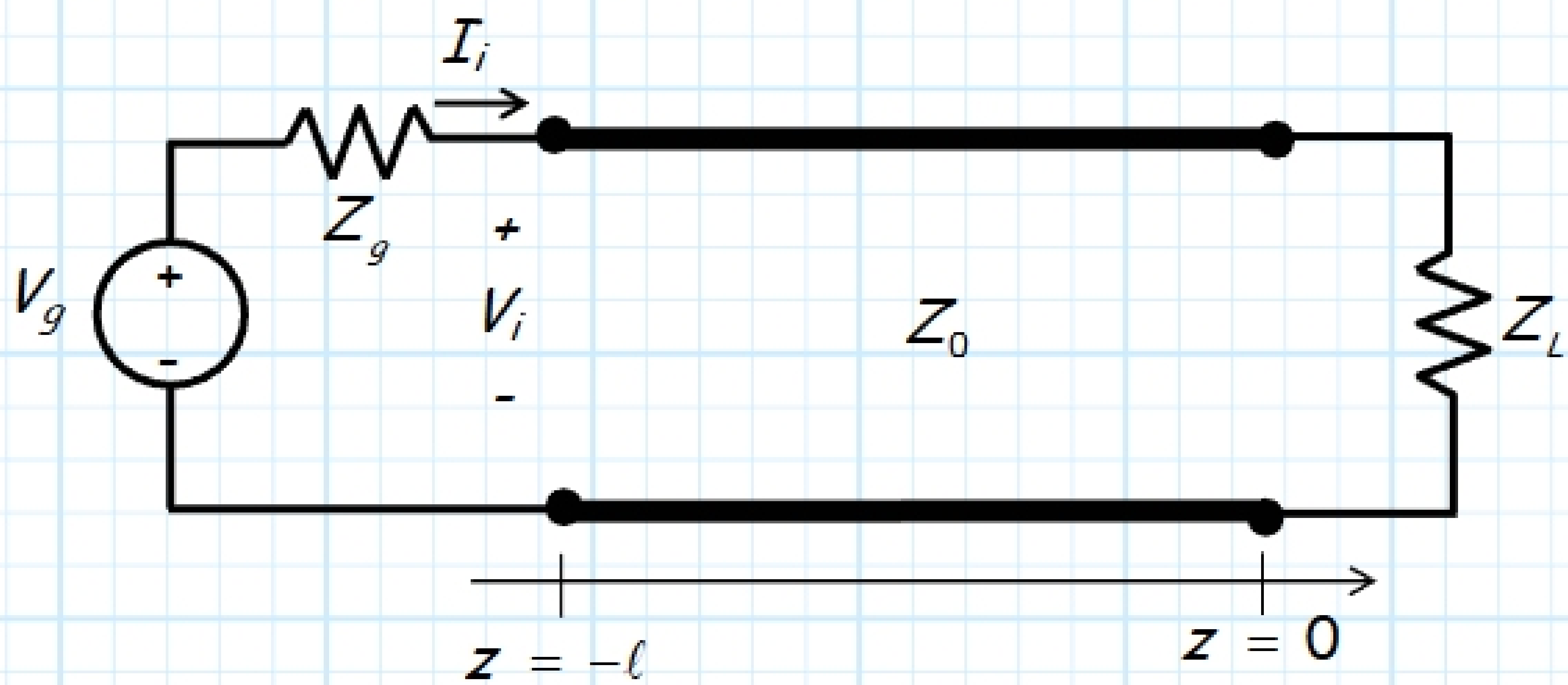




$$V_g = V_i + Z_g\, I_i$$

$$I_g = \frac{V_i}{Z_g} + I_i$$

Typically, the power source is modeled with its **Thevenin's** equivalent; however, we will find that the **Norton's** equivalent circuit is useful if we express the remainder of the circuit in terms of its **admittance** values (e.g., $Y_0, Y_L, Y(z)$).



Recall from the telegrapher's equations that the current and voltage along the transmission line are:

$$V(z) = V_0^+ e^{-j\beta z} + V_0^- e^{+j\beta z}$$

$$I(z) = \frac{V_0^+}{Z_0} e^{-j\beta z} - \frac{V_0^-}{Z_0} e^{+j\beta z}$$

At $z = 0$, we enforced the **boundary condition** resulting from Ohm's Law:

$$Z_L = \frac{V_L}{I_L} = \frac{V(z=0)}{I(z=0)} = \frac{\left(V_0^+ + V_0^-\right)}{\left(\frac{V_0^+}{Z_0} - \frac{V_0^-}{Z_0}\right)}$$