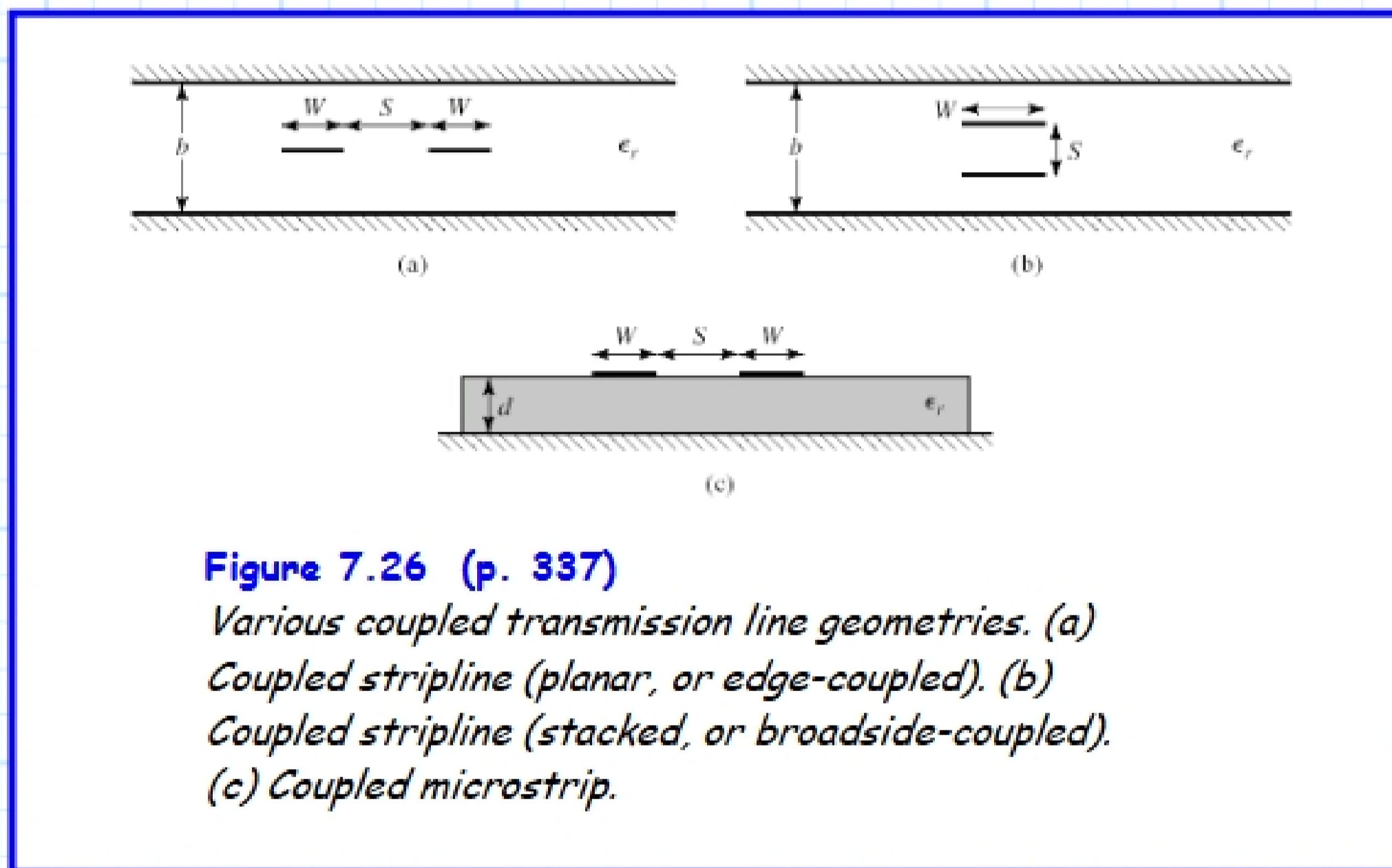


Coupled-Line Couplers

Two transmission lines in **proximity** to each other will **couple** power from one line into another.

This proximity will **modify** the electromagnetic fields (and thus modify voltages and currents) of the propagating wave, and therefore **alter** the **characteristic impedance** of the transmission line!



Generally, speaking, we find that this transmission lines are **capacitively coupled** (i.e., it appears that they are connected by a capacitor):

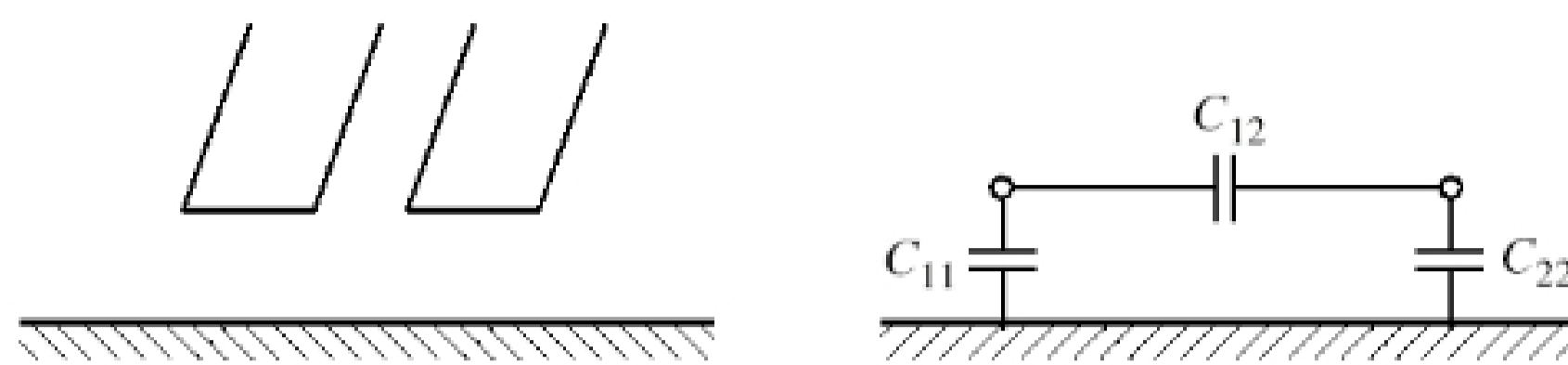
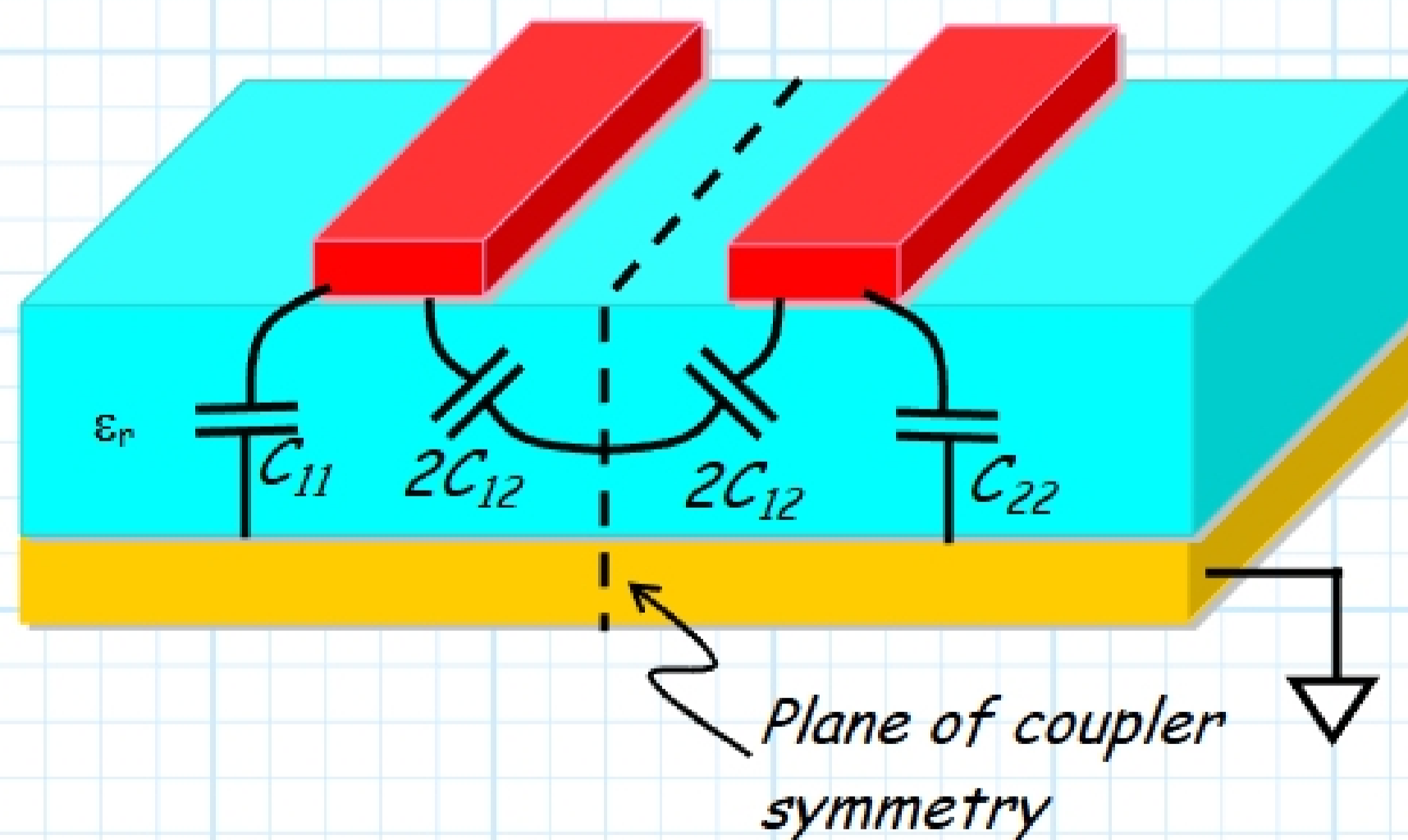


Figure 7.27 (p. 337)

A three-wire coupled transmission line and its equivalent capacitance network.

If the two transmission lines are **identical** (and they typically are), then $C_{11} = C_{22}$.

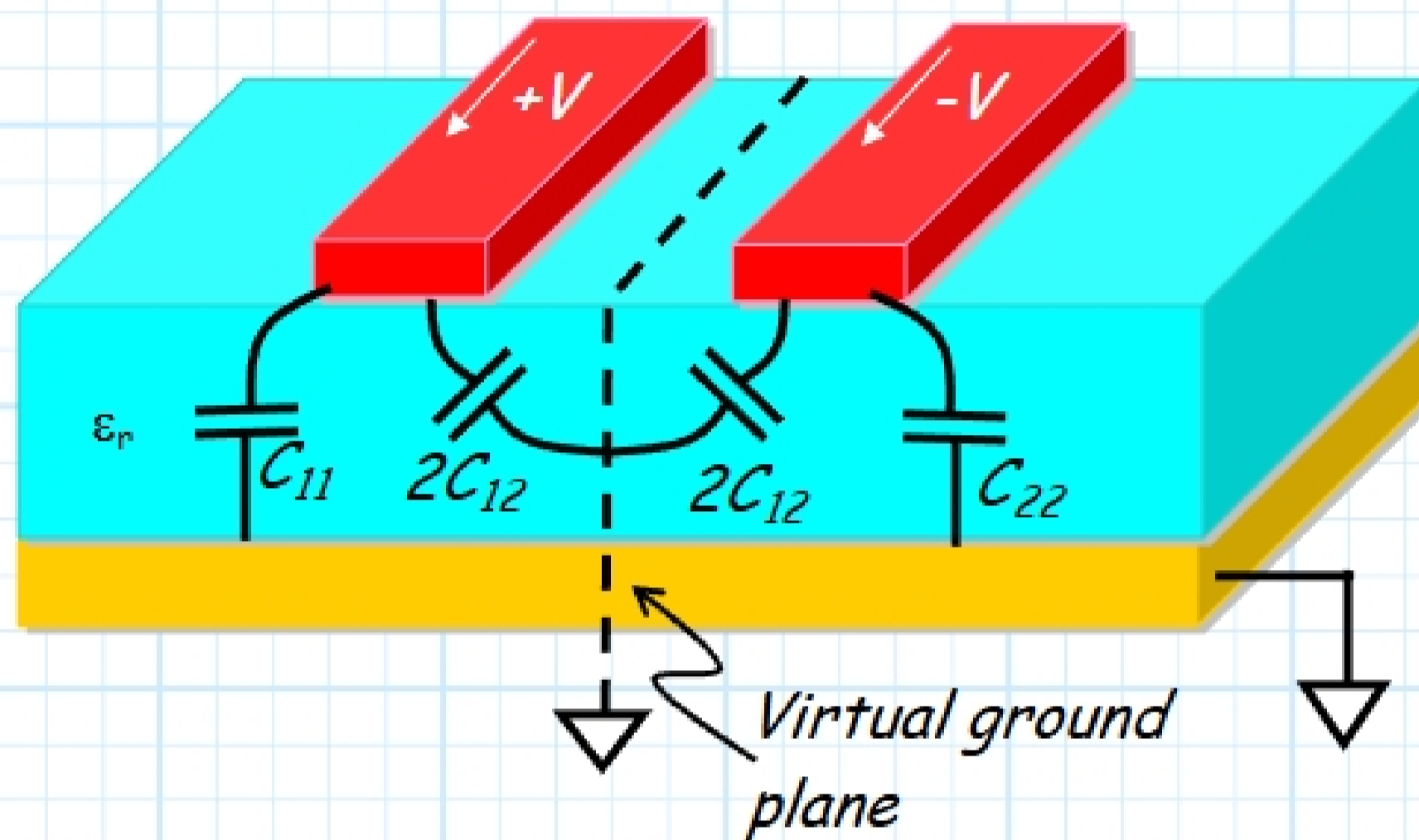
Likewise, if the two transmission lines are identical, then a plane of circuit **symmetry** exists. As a result, we can analyze this circuit using **odd/even mode** analysis!



Note we have divided the C_{12} capacitor into two **series** capacitors, each with a value $2 C_{12}$.

Odd Mode

If the incident wave along the two transmission lines are **opposite** (i.e., equal magnitude but 180° out of phase), then a virtual **ground plane** is created at the plane of circuit symmetry.



Thus, the capacitance per unit length of each transmission line, in the **odd** mode, is thus:

$$C_o = C_{11} + 2C_{12} = C_{22} + 2C_{12}$$

and thus its characteristic impedance is:

$$Z_o = \sqrt{\frac{L}{C_o}}$$