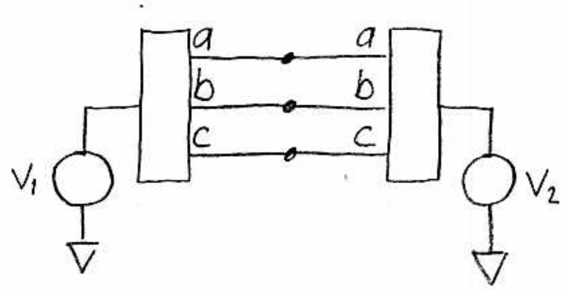
BARTLETT'S BISECTION THEOREM

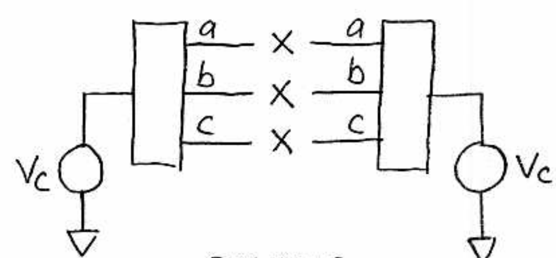
Analysis using symmetry – "half circuit"

Consider two completely symmetrical circuits: a,b,c are connected points of symmetry



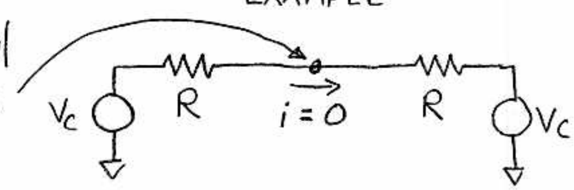
COMMON MODE

If $V_1 = V_2 = V_c$ (both circuits have the same input; symmetric excitation) ⇒ then we can <u>open</u> all leads between points of symmetry without affecting circuit operation; no current flows across any connection



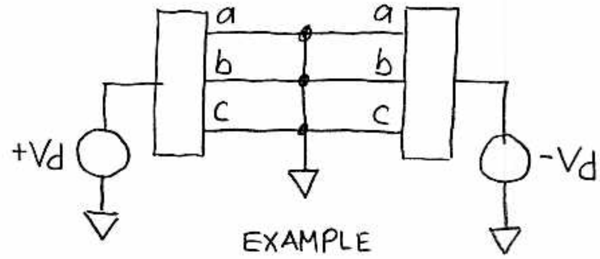
EXAMPLE: $i=0$ (no voltage drop across Rs due to symmetrical excitation. We can open this connection without affecting performance

EXAMPLE



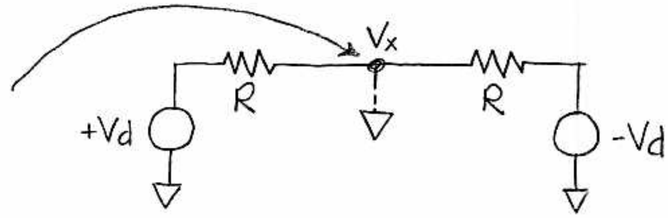
DIFFERENTIAL MODE

If $V_1 = -V_2$ (antisymmetric excitation) ⇒ then we can signal ground all leads between points of symmetry



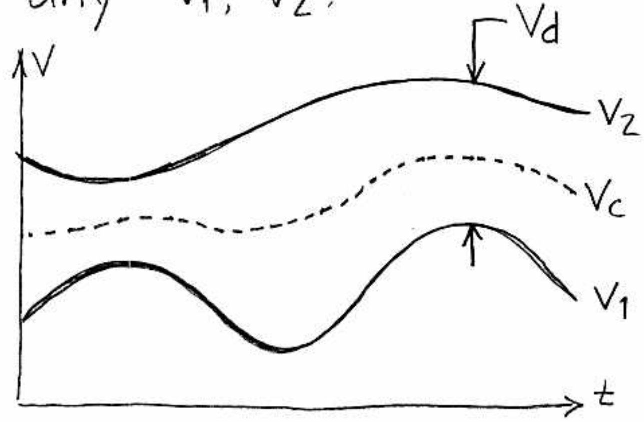
EXAMPLE: by voltage divider, $V_x = 0$ regardless of V_d. Therefore we can signal ground this connection without affecting circuit performance

EXAMPLE



Any two signals can be expressed in terms of common mode, differential mode

Consider any V_1, V_2:



Define

$$V_c = \frac{V_1 + V_2}{2}$$

$$V_d = V_2 - V_1$$

Straightforward to verify that

$$V_1 = V_c - \frac{V_d}{2}$$

$$V_2 = V_c + \frac{V_d}{2}$$

Key: analyze differential amplifier by decomposing inputs into V_c and V_d, then using symmetry (Bartlett's bisection theorem) and superposition