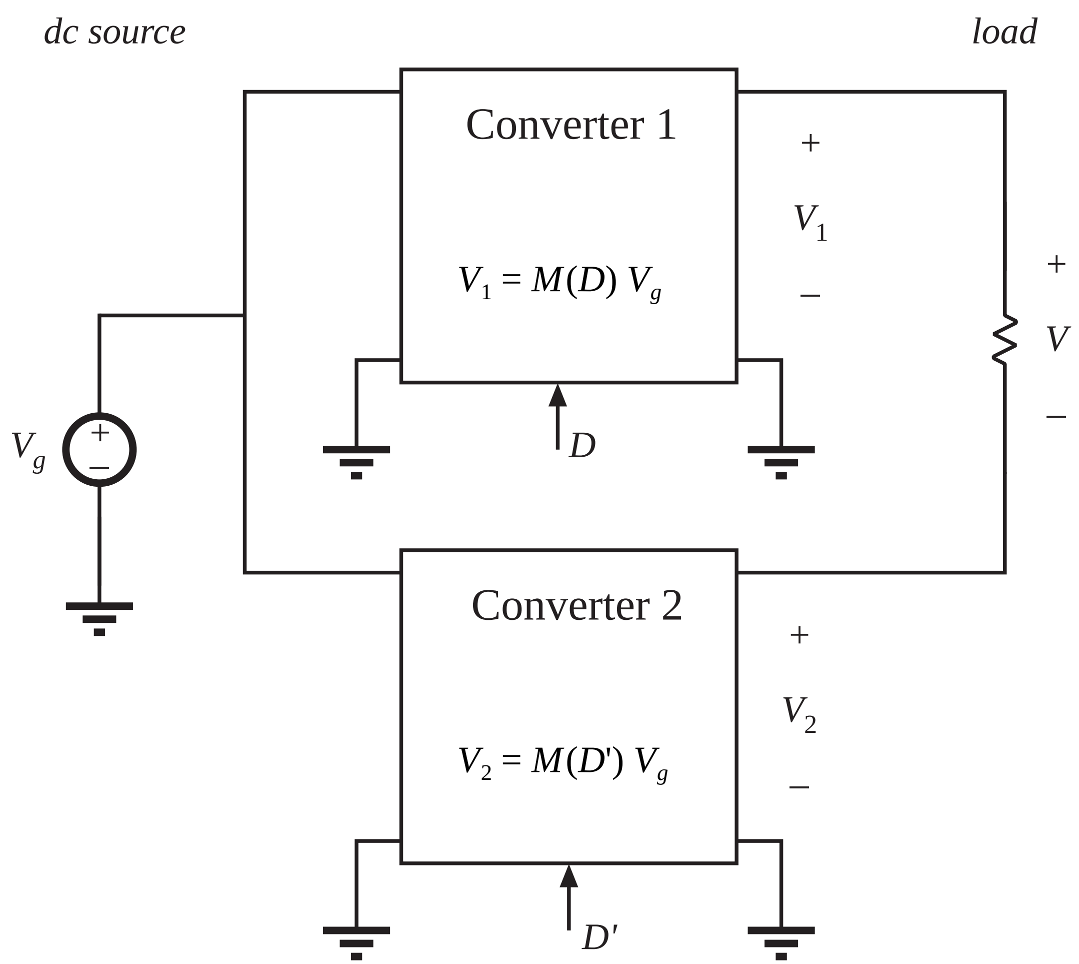
6.1.4. Differential connection of load to obtain bipolar output voltage

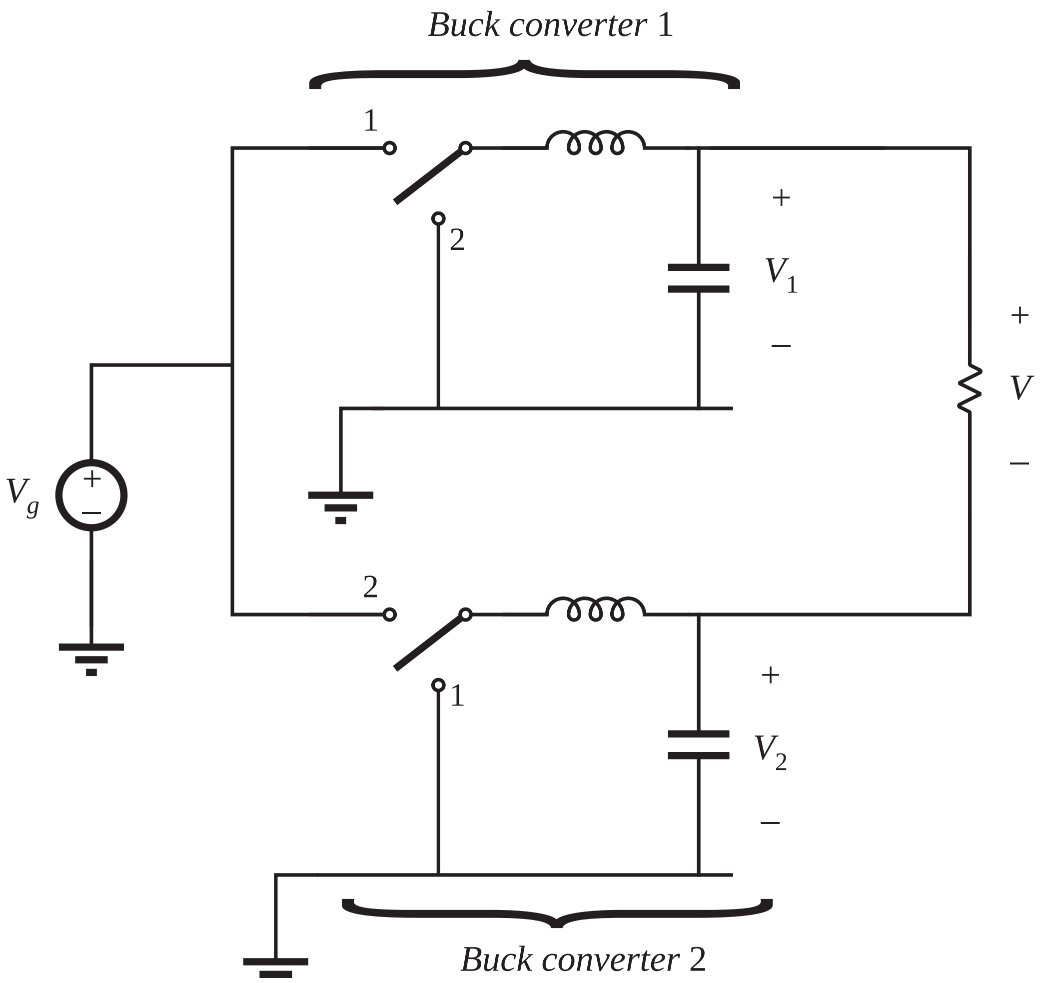


Differential load voltage is

$$V = V_1 - V_2$$

The outputs V_1 and V_2 may both be positive, but the differential output voltage V can be positive or negative.

Differential connection using two buck converters



Converter #1 transistor driven with duty cycle D

Converter #2 transistor driven with duty cycle complement D'

Differential load voltage is

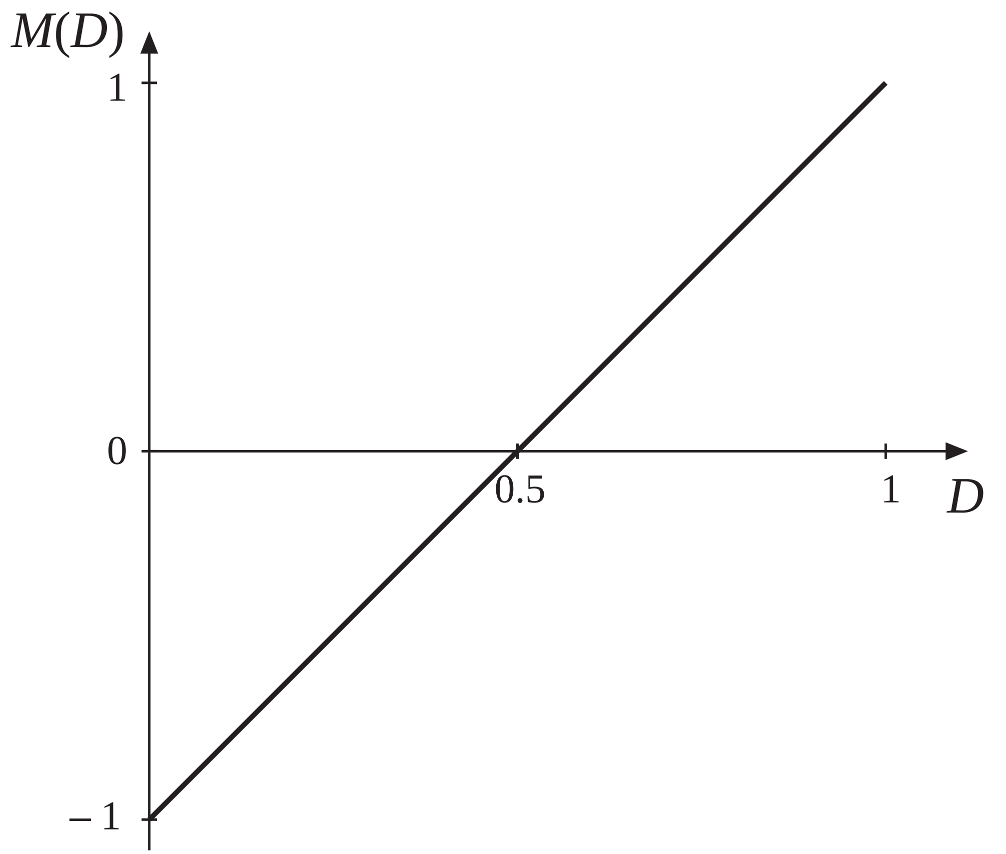
$$V = DV_g - D'V_g$$

Simplify:

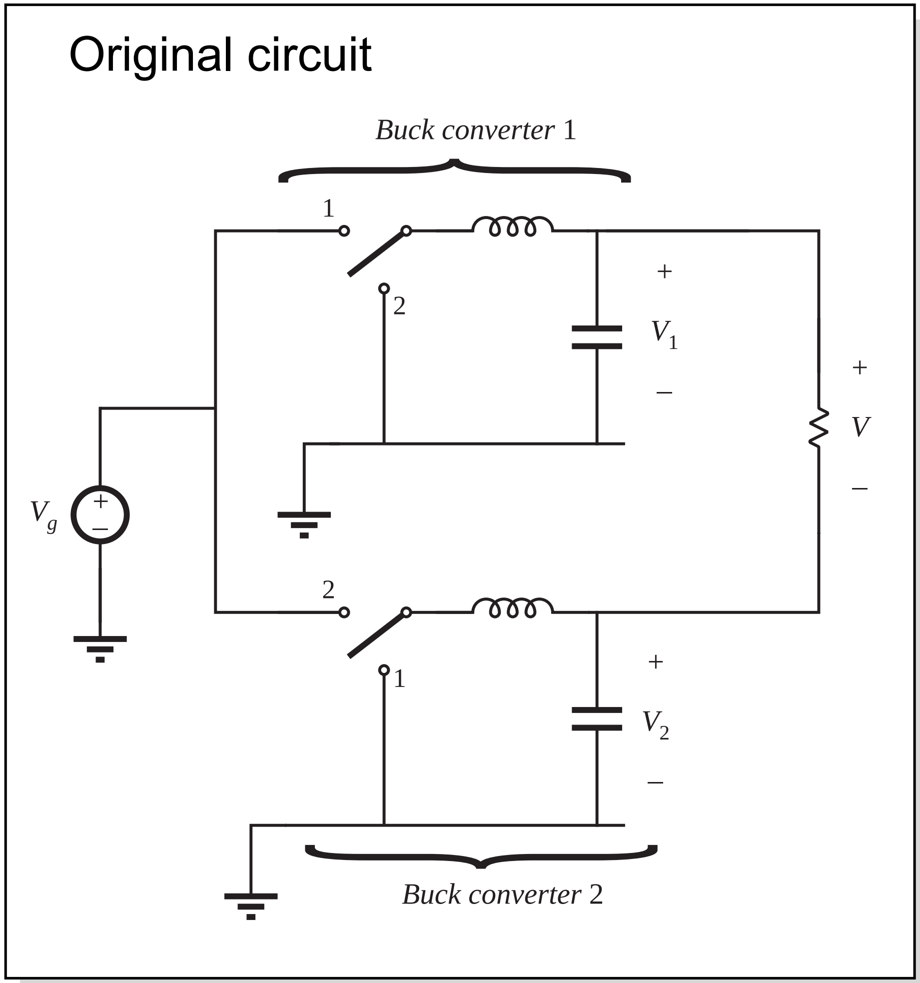
$$V = (2D - 1)V_g$$

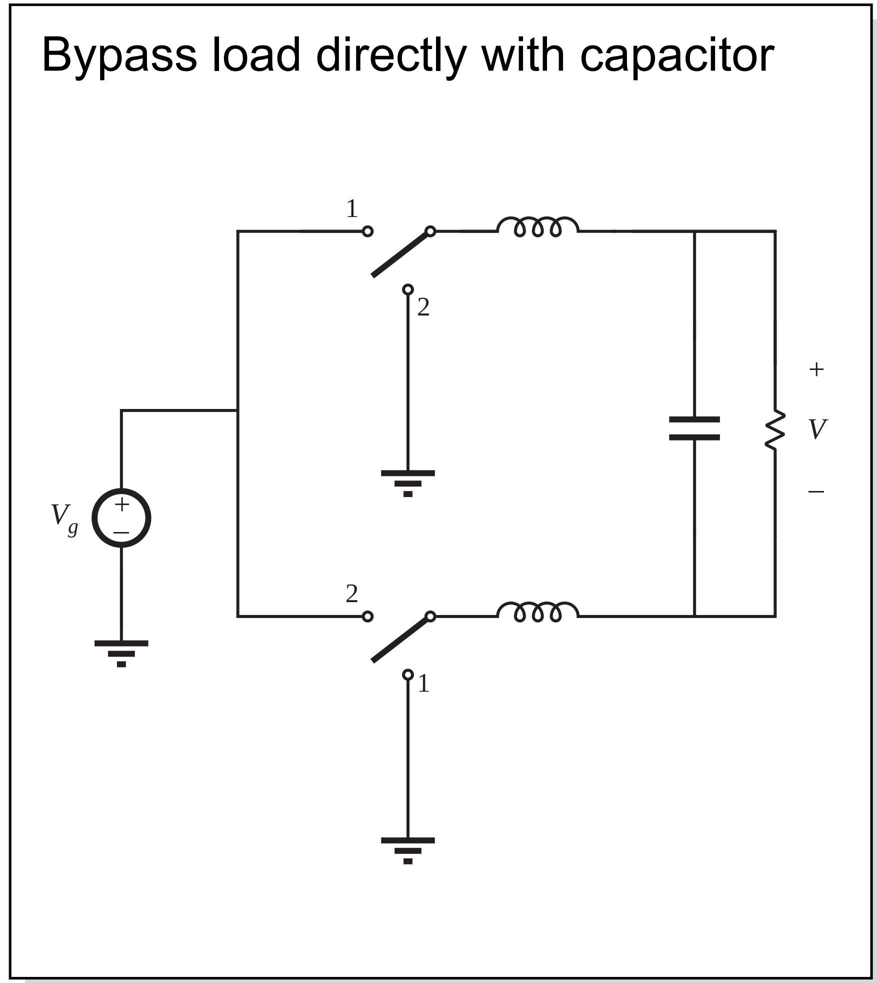
Conversion ratio $M(D)$, differentially-connected buck converters

$$V = (2D - 1)V_g$$



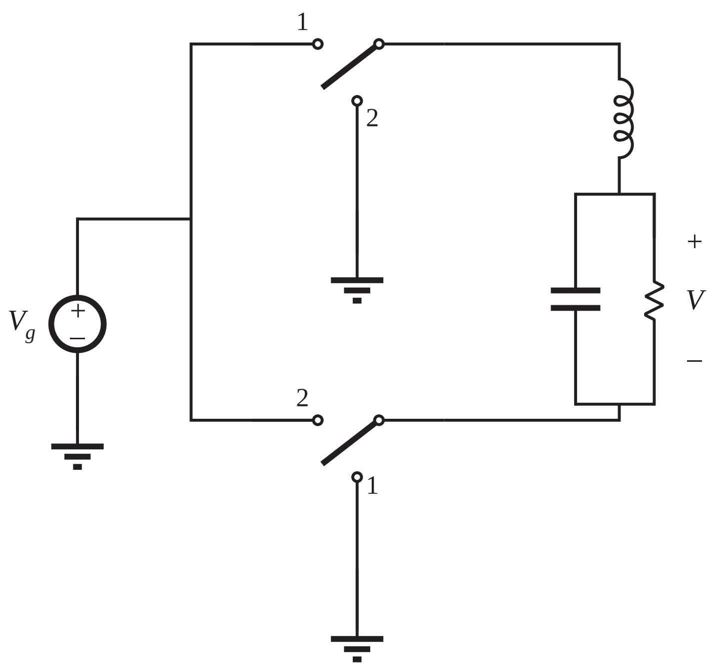
Simplification of filter circuit, differentially-connected buck converters



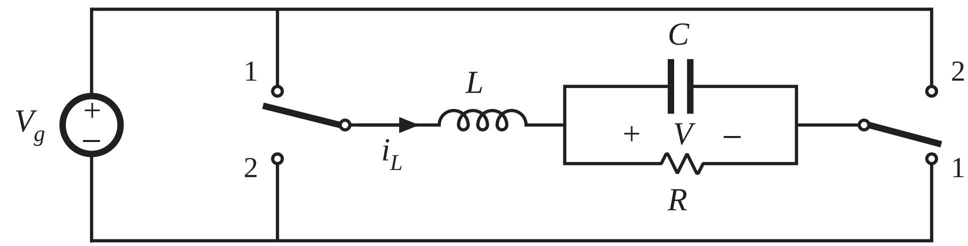


Simplification of filter circuit, differentially-connected buck converters

Combine series-connected inductors



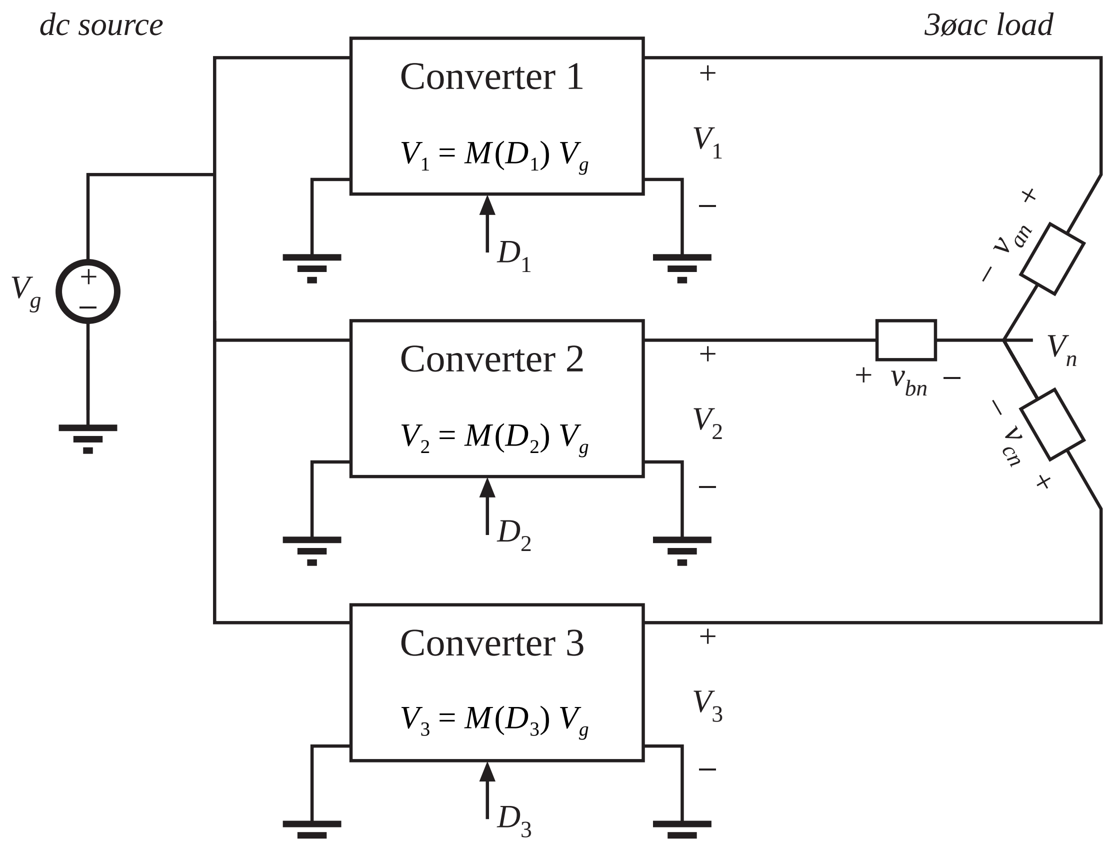
Re-draw for clarity



H-bridge, or bridge inverter

Commonly used in single-phase inverter applications and in servo amplifier applications

Differential connection to obtain 3ø inverter



With balanced 3ø load, neutral voltage is

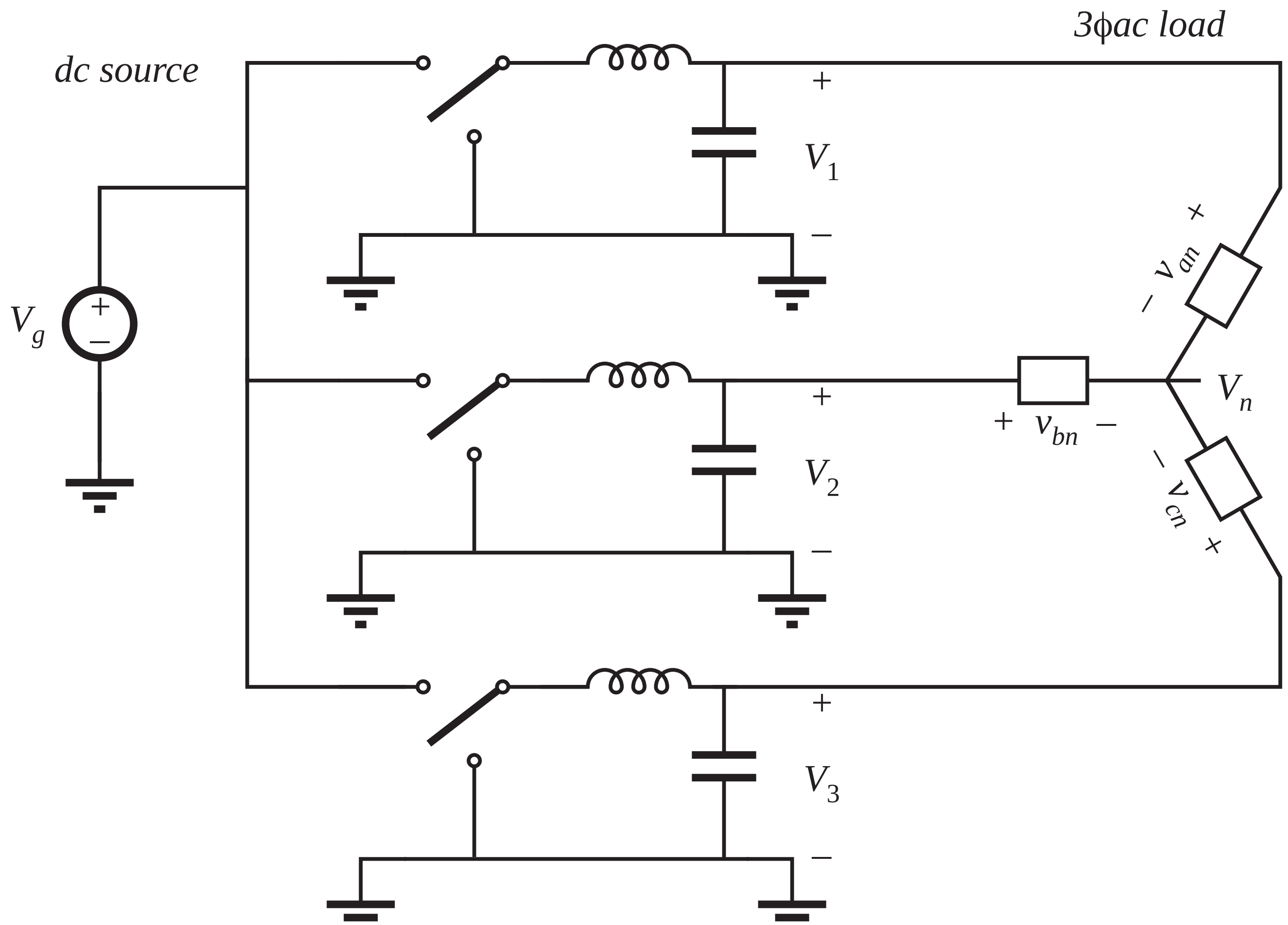
$$V_n = \frac{1}{3}\left(V_1 + V_2 + V_3\right)$$

Phase voltages are

$$V_{an} = V_1 - V_n$$
$$V_{bn} = V_2 - V_n$$
$$V_{cn} = V_3 - V_n$$

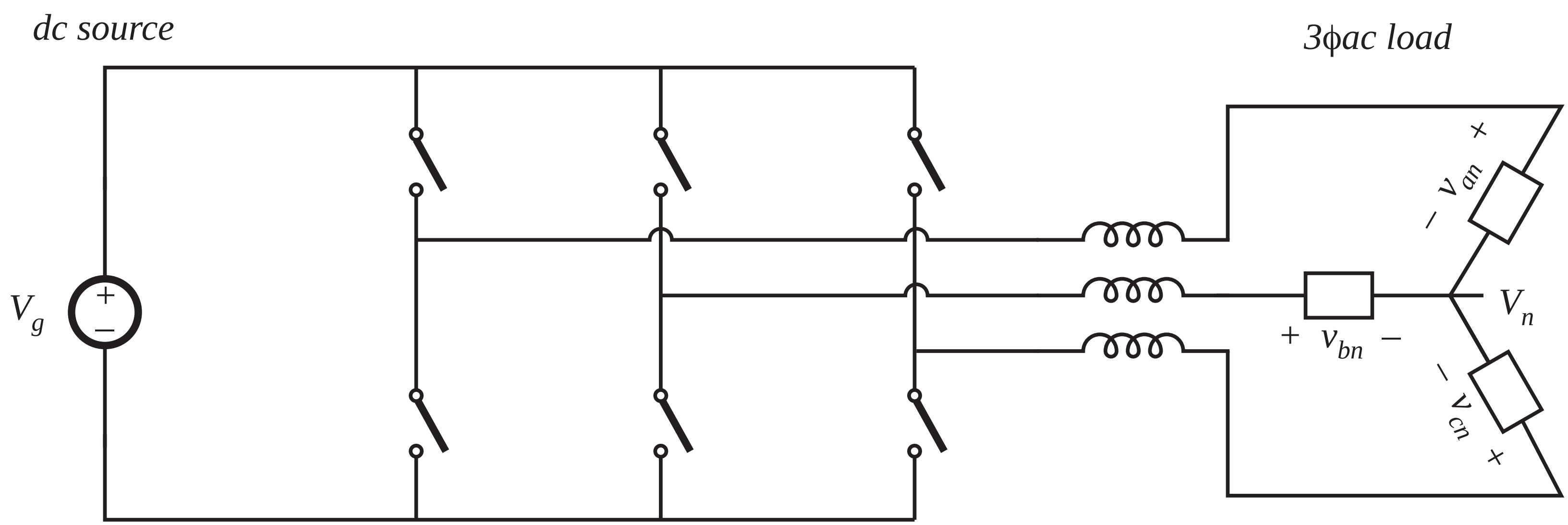
Control converters such that their output voltages contain the same dc biases. This dc bias will appear at the neutral point V_n. It then cancels out, so phase voltages contain no dc bias.

3ø differential connection of three buck converters



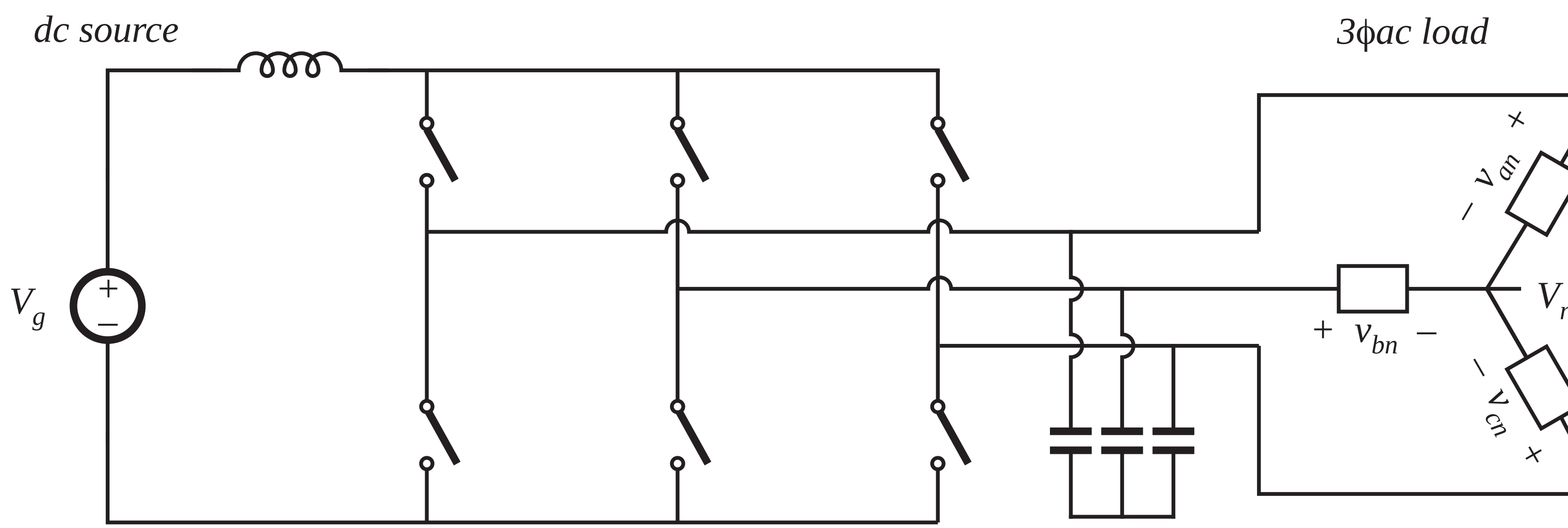
3ø differential connection of three buck converters

Re-draw for clarity:



"Voltage-source inverter" or buck-derived three-phase inverter

The 3ø current-source inverter



• Exhibits a boost-type conversion characteristic