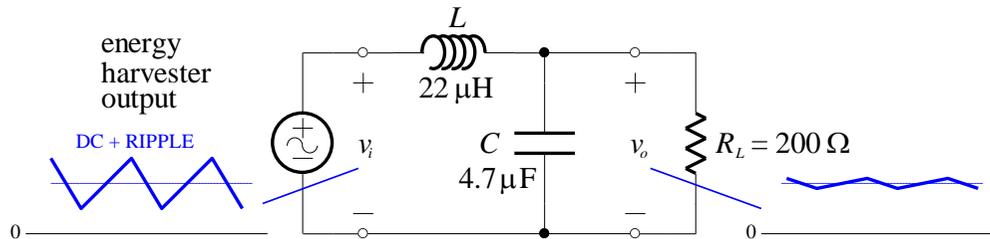


11 Energy Harvester Output Filter

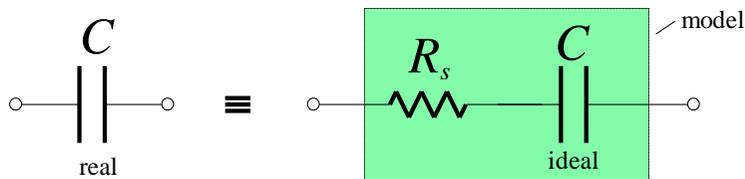
A *Personal Solar Torch* has an energy harvester circuit, whose output is filtered as shown below:



For analysis purposes, the input voltage can be approximated as:

$$v_i(t) = 4 + 2 \cos(2\pi \times 10^6 t) \text{ V}$$

From the capacitor datasheet, at a frequency of 1 MHz, the capacitor has an equivalent series resistance (ESR) of $R_s = 100 \text{ m}\Omega$:



- Redraw the output circuit, using a better circuit model for the capacitor.
- What is the DC output voltage?
- To analyse the AC component of the input, transform the circuit into the frequency-domain.
- Find the ratio of the output voltage ripple to the input voltage ripple, i.e. $|\mathbf{V}_o/\mathbf{V}_i|$.
- Convert the above magnitude ratio into decibels, which is the usual unit of “ripple rejection” in engineering.