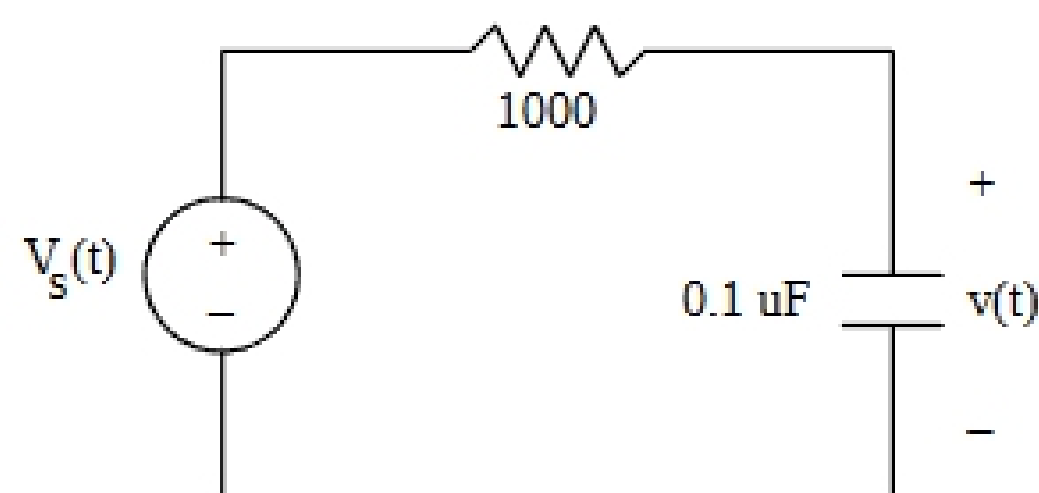
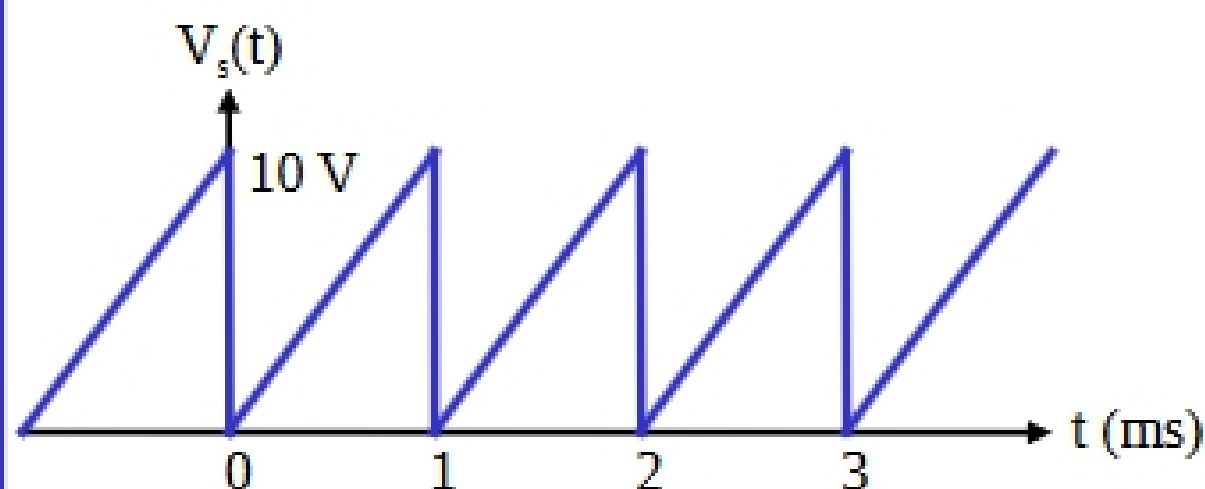


Read: Ch. 16 in *Electric Circuits, 9th Edition* by Nilsson

Circuit Analysis with periodic waveform inputs

Key: After representing the periodic waveform with a Fourier series, use superposition and standard AC circuit analysis (phasor analysis). Each harmonic must be handled separately since the impedance of each L and C changes with frequency.

Example: Determine the RMS value of the capacitor voltage, $v(t)$, in the circuit shown below. The input voltage, $V_s(t)$, is an infinite periodic 0 to 10V ramp waveform.



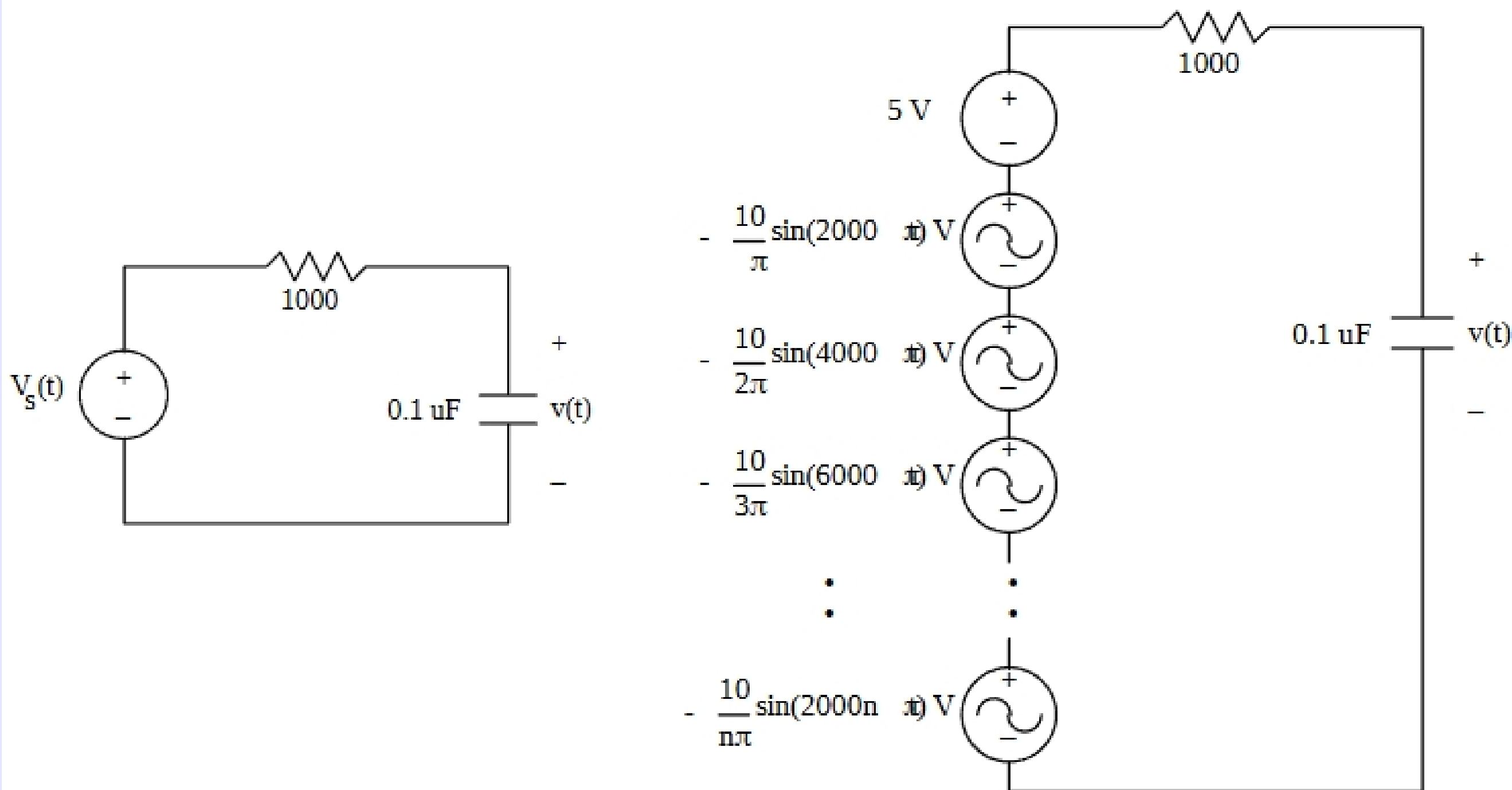
First, find the Fourier series for $V_s(t)$:

$$V_s(t) = 5 - \frac{10}{\pi} \sin(2000\pi t) - \frac{10}{2\pi} \sin(4000\pi t) - \frac{10}{3\pi} \sin(6000\pi t) - \frac{10}{4\pi} \sin(8000\pi t) - \dots$$

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We can now replace the ramp voltage source in the circuit by an infinite number of sinusoidal voltage sources as shown below:

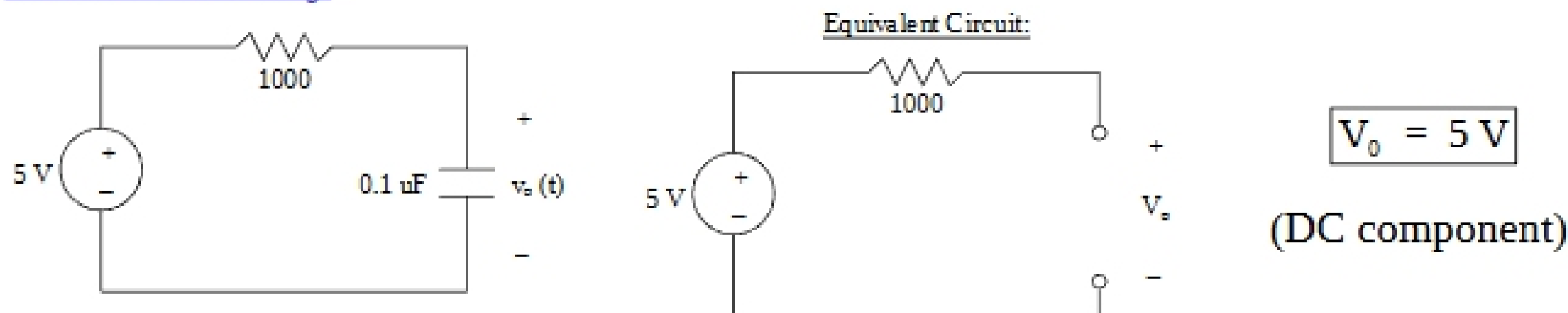
$$V_s(t) = 5 - \frac{10}{\pi} \sin(2000\pi t) - \frac{10}{2\pi} \sin(4000\pi t) - \frac{10}{3\pi} \sin(6000\pi t) - \frac{10}{4\pi} \sin(8000\pi t) - \dots$$



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Now using superposition the circuit can be analyzed once for each source with all other sources killed (shorted). Note that the capacitor impedance changes for each circuit.

DC source only:



First harmonic source only:

