

ELEC-E8412 Power Electronics

/ Exercise # 2

15.10.2020

Problem 1: (Chapter 1)

A sinusoidal voltage source of $v(t) = 40 \cos(2\pi 50t)$ V is applied to a nonlinear load, resulting in a non-sinusoidal current which is expressed in Fourier series as $i(t) = 3 + 7 \cos(2\pi 50t + 20^\circ) + 4 \cos(6\pi 50t + 15^\circ) + 3 \cos(8\pi 50t + 25^\circ)$ A. Determine

- (a) the power absorbed by the load,
- (b) the power factor of the load, and
- (d) the total harmonic distortion of the load current.

Problem 2: (Chapter 1)

The voltage and current for a circuit element are

$$v(t) = 3 + 5 \cos(2\pi 60t + 15^\circ) + 2 \cos(4\pi 60t) \text{ V and}$$
$$i(t) = 2 + 7 \cos(2\pi 60t + 45^\circ) + 3 \cos(6\pi 60t + 25^\circ) \text{ A.}$$

- (a) Determine the rms values of voltage and current.
- (b) Determine the power absorbed by the element.

Problem 3:

For the half-wave rectifier, the source is a sinusoid of 300 V rms at a frequency of 50 Hz. The load resistor is 25. Determine

- (a) the average load current,
- (b) the power absorbed by the load,
- (c) the apparent power supplied by the source, and
- (d) the power factor of the circuit.

Problem 4:

For the half-wave rectifier with R-L load, $R=100\Omega$, $L=0.1$ H, $\omega=377$ rad/s, and $V_m = 100$ V.

Determine

- (a) an expression for the current in this circuit,
- (b) the average current,
- (c) the rms current
- (d) the power absorbed by the resistor, and
- (e) the power factor.

Problem 5:

For a half-wave rectifier with R-L load with $V_{in} = 300\sin(377t)$ and $R=12\Omega$ and $L=12$ mH.

Determine

- (a) an expression for load current,
- (b) the average current,
- (c) the power absorbed by the resistor, and
- (d) the power factor.