

# Electrical Power Engineering Fundamentals

Departamento de Ingeniería Eléctrica. Universidad Carlos III de Madrid

Module 3. Analysis of AC Circuits. Week 7.

**Exercise 1.** In the circuit below, find  $u_1(t)$ ,  $u_2(t)$  and check the power balance:

$$U_g(t) = 180\sqrt{2}\cos(1000t) \text{ V}$$

$$I_g(t) = 12\sqrt{2}\cos(1000t) \text{ A}$$

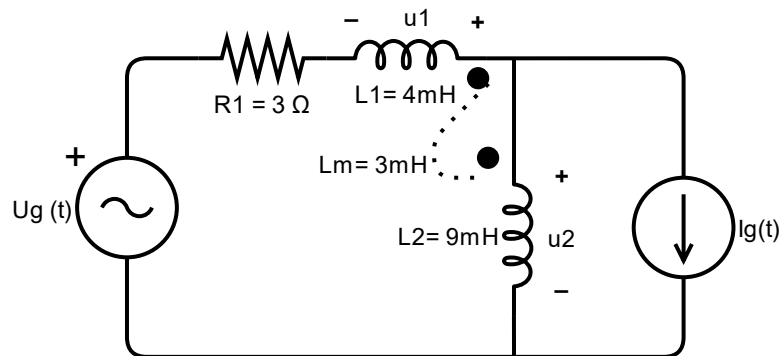


Figure 1 AC circuit 1

**Solution:**  $e_1(t) = 80.5\cos(1000t - 108.435^\circ) \text{ V}$ ;  $e_2(t) = 108\sqrt{2}\cos(1000t) \text{ V}$ ;  $P_{R1} = 1944\text{W}$ ;  $S_{L1} = -648 + 1296j \text{ VA}$ ;  $S_{L2} = 648 + 1944j \text{ VA}$ ;  $S_{I_g} = -1296 + 0j \text{ VA}$ ;  $S_{U_g} = 3240 + 3240j \text{ VA}$ ;

**Exercise 2.** In the circuit below, find  $u_1(t)$ ,  $u_2(t)$  and  $U_{ig}(t)$ :

$$U_g(t) = \sqrt{2}\cos(2t + 180^\circ) \text{ V}$$

$$I_g(t) = 2\sqrt{2}\sin(2t) \text{ A}$$

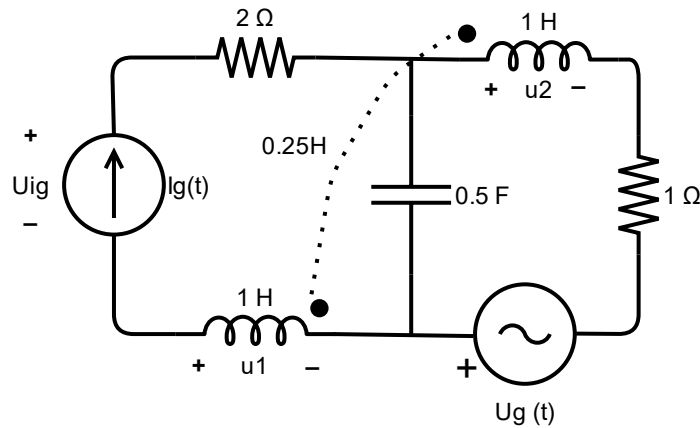


Figure 2 AC circuit 2

**Solution:**  $u_1(t) = 4.47\sin(2t - 108.4^\circ) \text{ V}$ ;  $u_2(t) = 7.07\sin(2t - 36.87^\circ) \text{ V}$ ;  $U_{ig}(t) = 10\sin(2t - 8.13^\circ) \text{ V}$ ;

**Exercise 3.** In the circuit below:

a) Find the current  $i(t)$  using a Thevenin equivalent circuit:

$$U_g(t) = \sqrt{2} \sin(1000t) \text{ V}$$

$$I_g(t) = \sqrt{2} \cos(1000t) \text{ A}$$

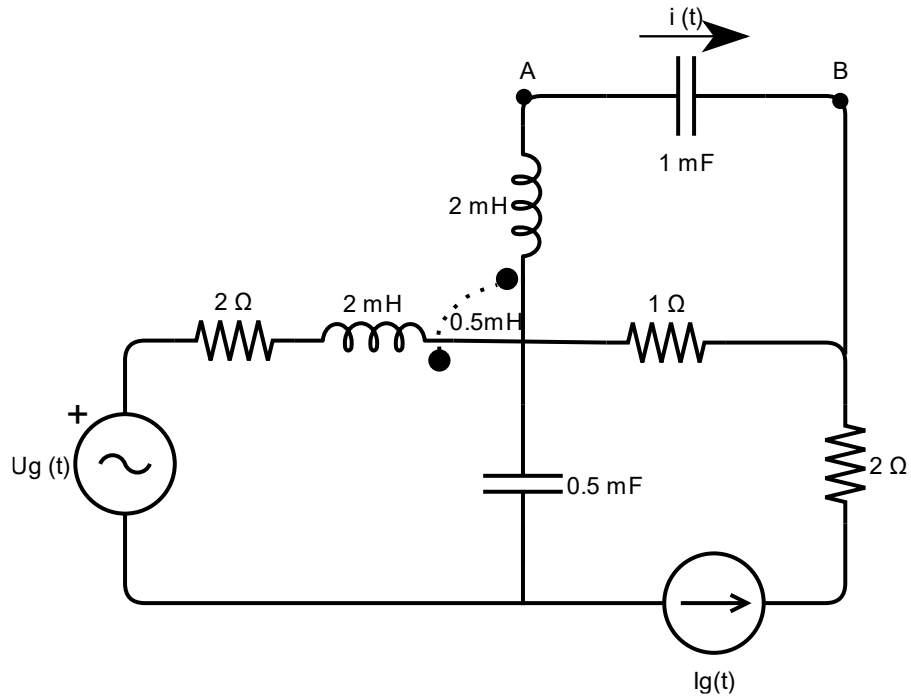


Figure 3. AC circuit 3

$U_{TH}(t) = 1.25\sqrt{2}\sin(1000t-90^\circ) \text{ V}; Z_{TH} = 1.125+2j \Omega; i(t) = 1.174\sin(1000t-131.63^\circ) \text{ A}$
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