Tutorial Sheet – No 1

(Revision)

1 Perform the following conversions from rectangular to polar form, and vice-versa. (Try these without using any conversion buttons on you calculator to ensure you know the formulas to covert from one coordinate system to the other).

$$\sqrt{3}+j1 \;=\; 2\angle 30^\circ$$

$$-3+j5 \;=\; 5.83\angle 121^\circ$$

2 Now attempt these examples using your calculator. Ensure you can convert both ways. (Many calculators will perform the conversions at a press of a button, but it is important to know how to do this).

$$3+j3 \;=\; 4.24\angle 45^\circ$$

$$2+j2\sqrt{3} \;=\; 4\angle 60^\circ$$

$$-3-j4 \;=\; 5\angle -126.9^\circ$$

3 Hence do the following phasor manipulations and 'discover' the most appropriate method. Give the answers in both polar and rectangular format.

$$3\angle 22^\circ + 4\angle 112^\circ \;=\; 5\angle 75.1^\circ \;=\; 1.28+j4.83$$

$$3\angle 22^\circ \times 4\angle 112^\circ \;=\; 12\angle 134^\circ \;=\; -8.34+j8.63$$

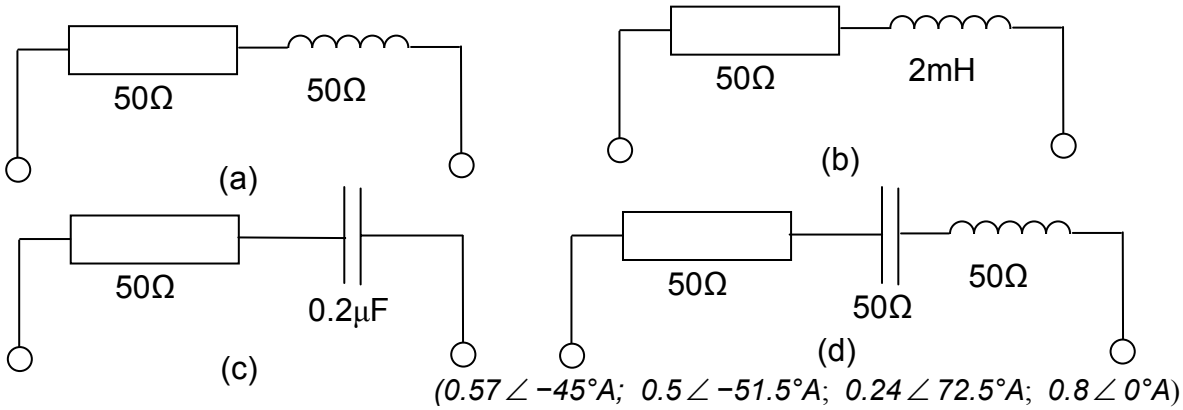
$$3\angle 22^\circ \div 4\angle 112^\circ \;=\; 0.75\angle -90^\circ \;=\; 0-j0.75$$

$$(1+j2)+(3+j4) \;=\; 4+j6 \;=\; 7.21\angle 56.3^\circ$$

$$(1+j2)\div(3+j4) \;=\; 0.44+j0.08 \;=\; 0.45\angle 10.3^\circ$$

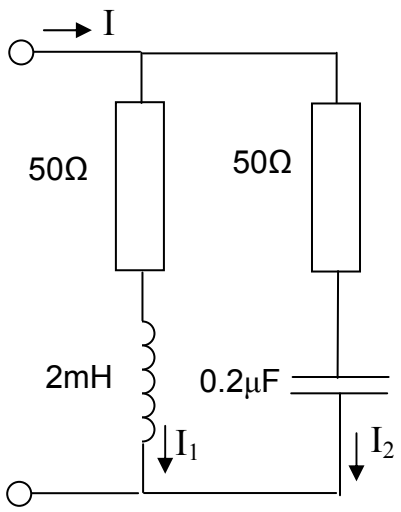
Hopefully, you will have found that multiplication and division are easier if the phasor is expressed in polar form, and addition and subtraction are easier using j notation. Most calculators make it easy to convert either way, but if your calculator can handle complex numbers directly then presumably conversion is not necessary.

4 Calculate the amplitude and phase of the peak current for each of the circuits below, assuming a sinusoidal voltage, having a peak amplitude of 40V and a frequency of 5kHz, is applied.

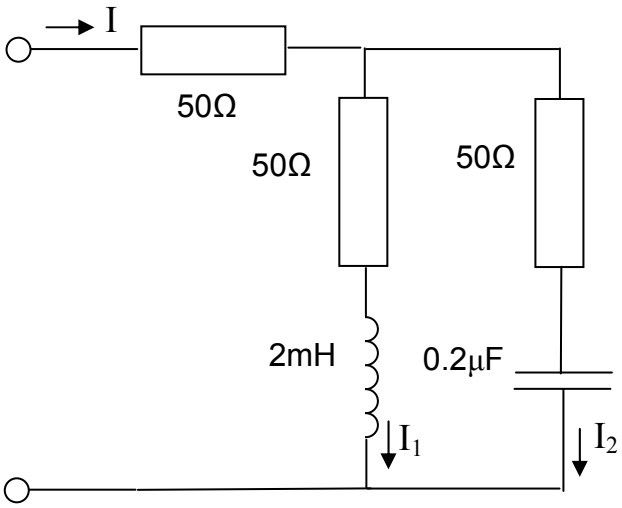


(0.57∠ −45°A; 0.5∠ −51.5°A; 0.24∠ 72.5°A; 0.8∠ 0°A)

5 Calculate the amplitude and phase of the input current to each of the following circuits assuming a sinusoidal voltage, having a peak amplitude of 40V and a frequency of 5kHz, is applied.



(a)



(b)

((*a*)$0.41\angle -22°A$; *(b)* $0.28\angle -15.1°A$)

At the end of this question, if you solved both parts by using the technique where you calculate the input impedance of the branches using $\frac{1}{Z_T}=\frac{1}{Z_1}+\frac{1}{Z_2}$ *(all impedances in complex form) you will realise that it is a tedious exercise! If in (a) you recognised that the two parallel branches have 40V across them then you could have calculated* $\bar{I}=\bar{I}_1+\bar{I}_2$ *where* $\bar{I}_1$ *and* $\bar{I}_2$ *are calculated as in question 4(b) and 4(c) – a much easier method. In general if you know the voltage across two parallel branches, use the latter method, not the former.*