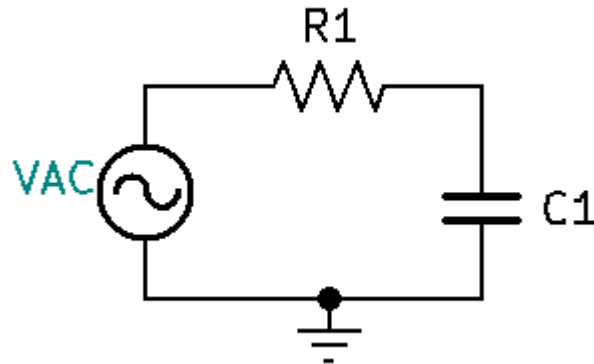


Consider the following circuit:



At resonance or  $F_c$ , we know that:

- @  $F_c$ ,  $X_{C_{C1}} = R1$
- $X_{C_{C1}} = \frac{1}{2\pi F C1}$
- $R1 = \frac{1}{2\pi F C1}$
- $F_c = \frac{1}{2\pi R1 C1}$

Let's assume that  $V_{gen}$  is equal to 10vp @ 1Khz, and  $X_{C_{C1}}$  and  $R1$  both equal to 1K $\Omega$  respectively.

- $X_{C_{C1}} = 1K\Omega \angle -90^\circ$
- $R1 = 1K\Omega \angle 0^\circ$
- $ZT = \sqrt{R1^2 + X_{C_{C1}}^2}$ ,  $\angle \tan^{-1} \frac{XC}{R}$ 
  - $ZT = \sqrt{1K^2 + 1K^2}$ ,  $\angle \tan^{-1} \frac{-1K}{1K}$
  - $ZT = 1.41421K\Omega$ ,  $\angle -45^\circ$
- $IT = \frac{V_{gen}}{ZT}$ 
  - $IT = \frac{10vp \angle 0^\circ}{1.4142K\Omega \angle -45^\circ}$
  - $IT = 7.07114mA \angle 45^\circ$
- $VR = IT \times R$ 
  - $VR = 7.07114mA \angle 45^\circ \times 1K\Omega \angle 0^\circ$
  - $VR = 7.07114vp \angle 45^\circ$
- $VC = IT \times X_{C_{C1}}$ 
  - $VC = 7.07114mA \angle 45^\circ \times 1K\Omega \angle -90^\circ$
  - $VC = 7.07114vp \angle -45^\circ$

With peak voltages and phase angles, we can calculate instantaneous voltages at any point with respect to time.

- $V_{inst} = V_{max} \sin(360Ft \pm \theta)$ 
  - $V_{Gen_{inst}} = 10vp \sin(360 \times 1Khz \times time \pm 0)$
  - $V_{R_{inst}} = 7.07vp \sin(360 \times 1Khz \times time + 45)$
  - $V_{C_{inst}} = 7.07vp \sin(360 \times 1Khz \times time - 45)$

| Time    | Vgen = 10vp(sin)(360*1Khz*time+0) | VR = 7.07vp(sin)(360*1khz*time+45) | VC = 7.07vp(sin)(360*1Khz*time-45) |
|---------|-----------------------------------|------------------------------------|------------------------------------|
| 0       | 0.000                             | 4.999                              | -4.999                             |
| 0.00005 | 3.090                             | 6.299                              | -3.210                             |
| 0.0001  | 5.878                             | 6.983                              | -1.106                             |
| 0.00015 | 8.090                             | 6.983                              | 1.106                              |
| 0.0002  | 9.511                             | 6.299                              | 3.210                              |
| 0.00025 | 10.000                            | 4.999                              | 4.999                              |
| 0.0003  | 9.511                             | 3.210                              | 6.299                              |
| 0.00035 | 8.090                             | 1.106                              | 6.983                              |
| 0.0004  | 5.878                             | -1.106                             | 6.983                              |
| 0.00045 | 3.090                             | -3.210                             | 6.299                              |
| 0.0005  | 0.000                             | -4.999                             | 4.999                              |
| 0.00055 | -3.090                            | -6.299                             | 3.210                              |
| 0.0006  | -5.878                            | -6.983                             | 1.106                              |
| 0.00065 | -8.090                            | -6.983                             | -1.106                             |
| 0.0007  | -9.511                            | -6.299                             | -3.210                             |
| 0.00075 | -10.000                           | -4.999                             | -4.999                             |
| 0.0008  | -9.511                            | -3.210                             | -6.299                             |
| 0.00085 | -8.090                            | -1.106                             | -6.983                             |
| 0.0009  | -5.878                            | 1.106                              | -6.983                             |
| 0.00095 | -3.090                            | 3.210                              | -6.299                             |
| 0.001   | 0.000                             | 4.999                              | -4.999                             |

