Prelab 2

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Part 1 – Integrator

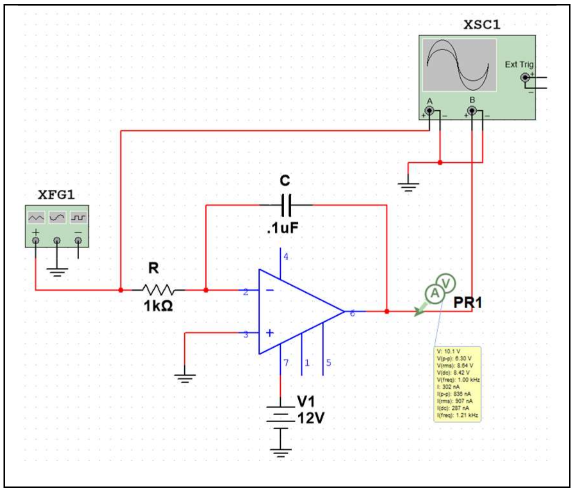


Figure 1: Integrator in Multisim

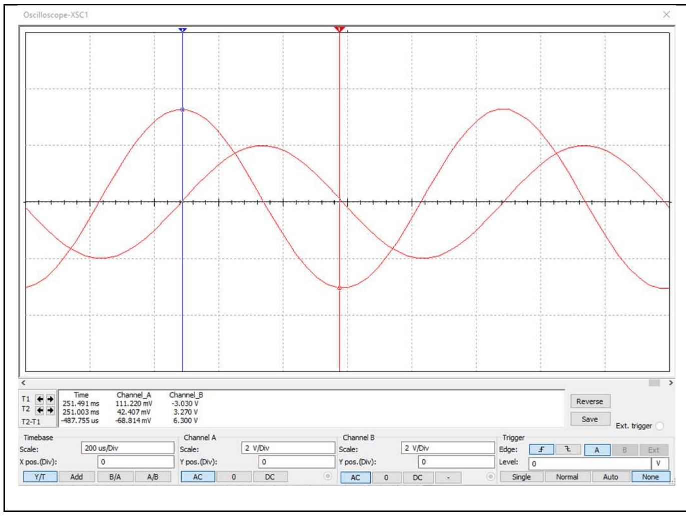
R = 1kΩ, C = 0.1 µF, f = 1 kHZ

V_{IN} = 2Vpp sinusoidal, triangle, square

a. *Plot the input and output waveforms on the same graph for two complete cycles.*
   - **See Figures 2-4**

b. *Comment on the gain and input-output phase relationship.*
   i. Figure 2 – Gain is 1.635 V/v – Input is sine and output is gain * cosx
   ii. Figure 3 – Gain is 1.239 V/v – On max / min input, output is 0.
   iii. Figure 4 – Gain is 2.472 V/v – When input changes direction, output is max / min.
   iv. Figure 5 – Gain is 0.164 V/v – Input is out of phase wrt output.
   v. Figure 6 – Gain is 0.133 V/v – On max / min input, output is 0.
   vi. Figure 7 – Gain is 0.234 V/v – When the input is changing, output is max / min.

c. ***Repeat for C = 1 µF and compare to your results with C = 0.1 µF.***
   - ***See Figures 5-7***



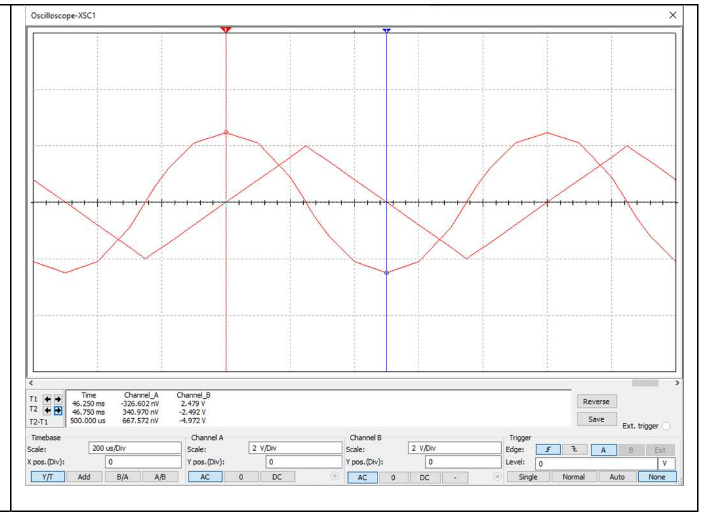
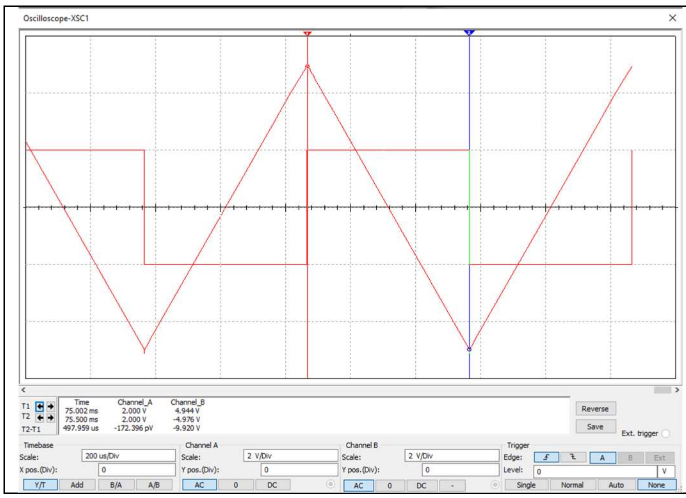


Figure 2: Integrator with sine wave R = 1kΩ, C = 0.1μF

Figure 3: Integrator with triangle wave R = 1kΩ, C = 0.1μF



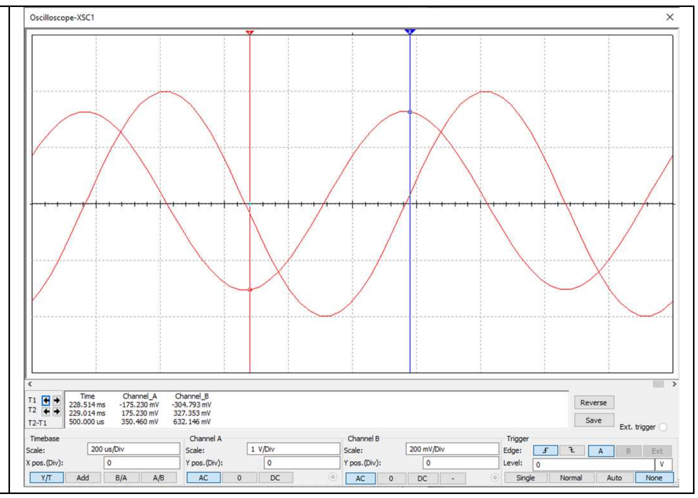
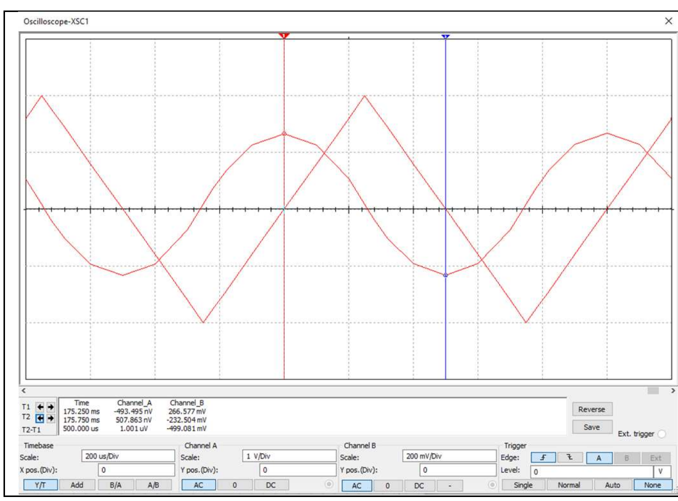


Figure 4: Integrator with square wave R = 1kΩ, C = 0.1μF

Figure 5: Integrator with sine wave R = 1kΩ, C = 1μF



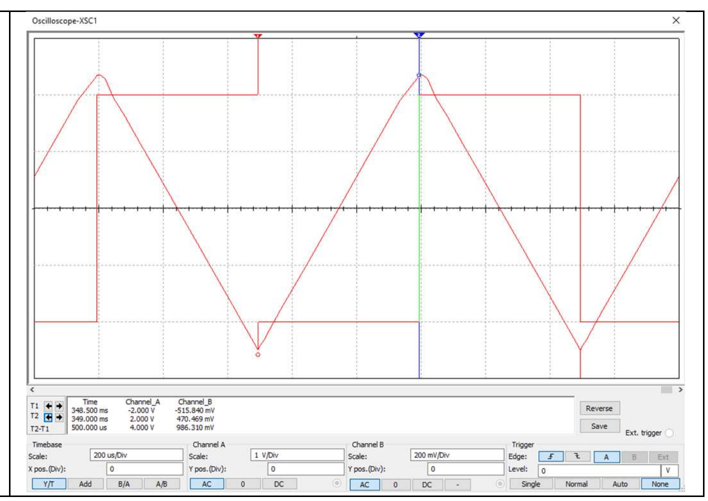


Figure 6: Integrator with triangle wave R = 1kΩ, C = 1μF

Figure 7: Integrator with square wave R = 1kΩ, C = 1μF

Part 2 – Differentiator

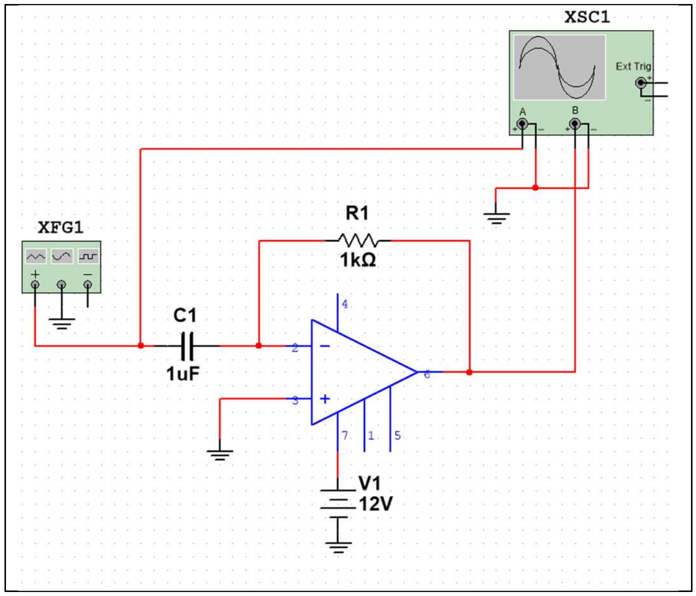


Figure 8: Differentiator in Multisim

R = 1kΩ, C = 0.1 µF, f = 1 kHZ

V_{IN} = 2Vpp sinusoidal, triangle, square

d. *Plot the input and output waveforms on the same graph for two complete cycles.*

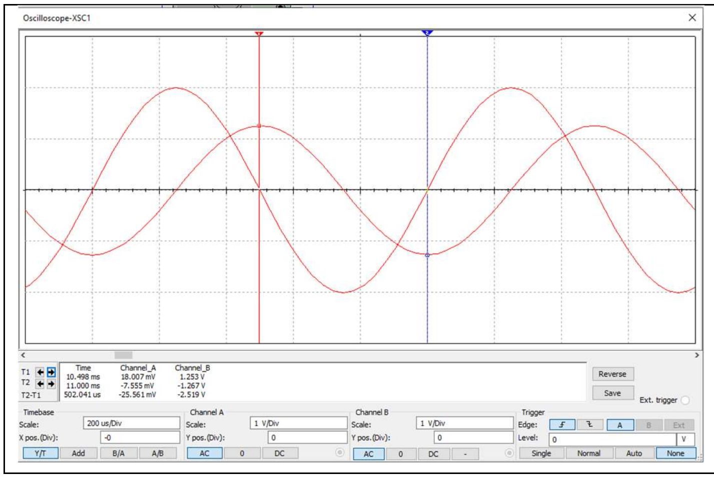
- **See Figures 9-11**

e. *Comment on the gain and input-output phase relationship.*

i. Figure 9 – Gain is 0.73 V/v – When input is sin, output is gain * cos
ii. Figure 10 – Gain is 1.07 V/v – When input inc / dec, output is damped oscillator.
iii. Figure 11 – Gain is 5.60 V/v – When input changes direction, output is max / min.
iv. Figure 12 – Gain is 5.41 V/v – The input is out of phase with output.
v. Figure 13 – Gain is 5.18 V/v – When input is at a minimum, output is decreasing.
vi. Figure 14 – Gain is 5.48 V/v – Output decreases as a reaction to the input gaining.

f. **Repeat for C = 1 µF and compare to your results with C = 0.1 µF.**

- **See Figures 12-14**



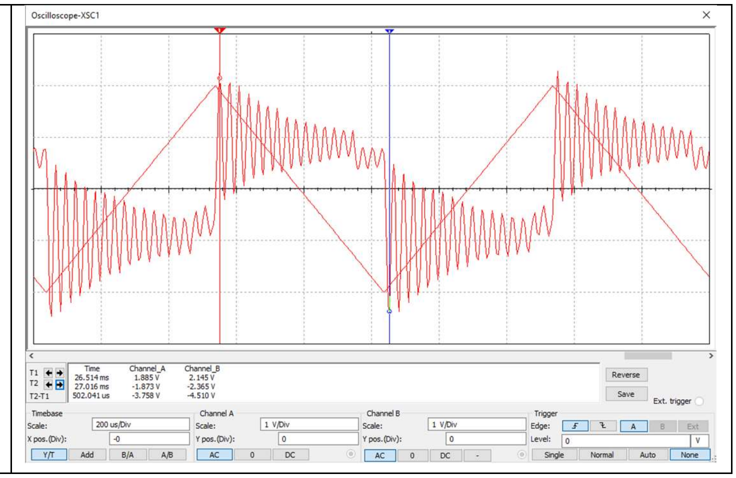
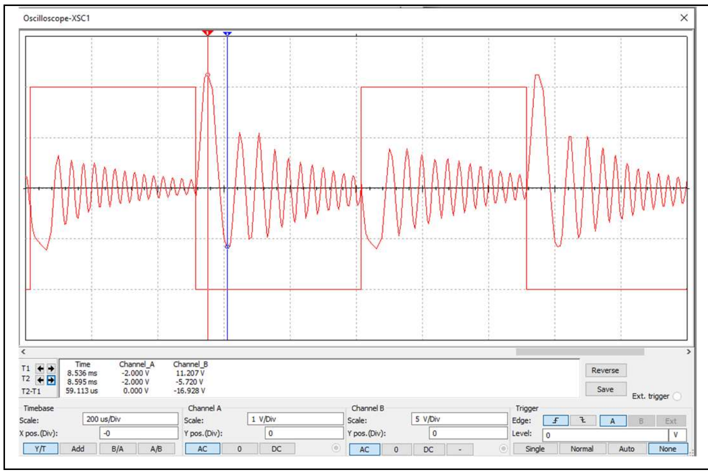


Figure 9: Differentiator with sine wave R = 1kΩ, C = 0.1μF Figure 10: Differentiator with triangle wave R = 1kΩ, C = 0.1μF



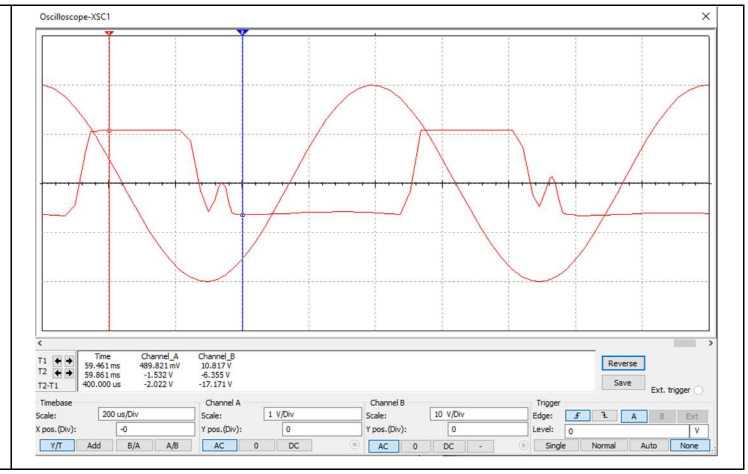
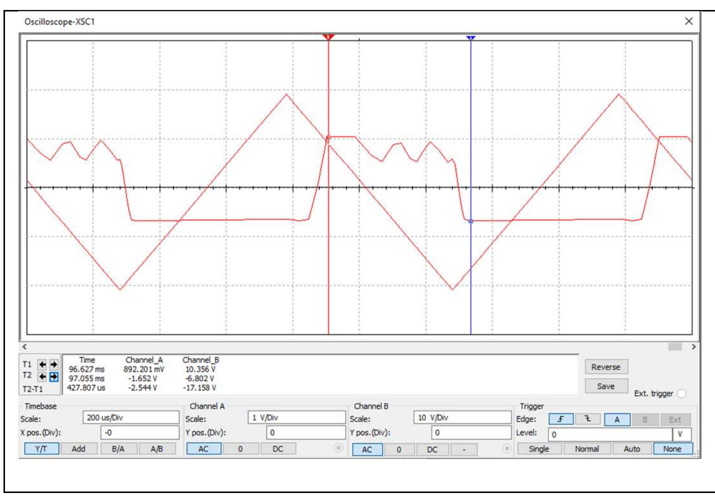


Figure 11: Differentiator with square wave R = 1kΩ, C = 0.1μF Figure 12: Differentiator with sine wave R = 1kΩ, C = 1μF



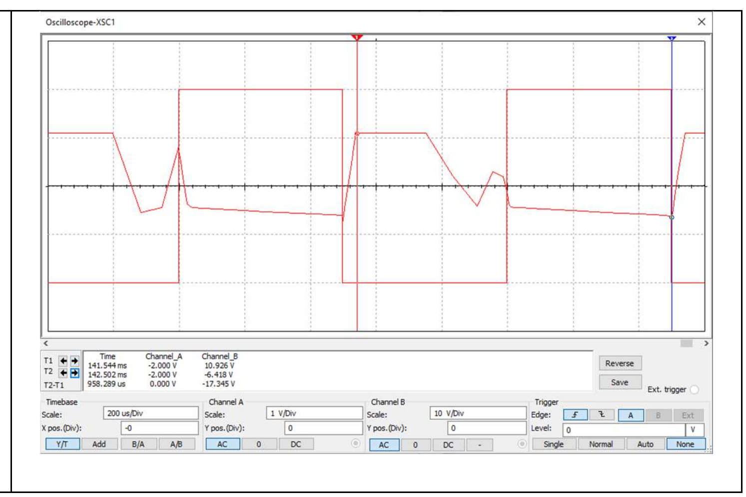


Figure 13: Differentiator with triangle wave R = 1kΩ, C = 1μF Figure 14: Differentiator with square wave R = 1kΩ, C = 1μF